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3rd Quarter
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Volume 2
Number 3

Maritime Professional

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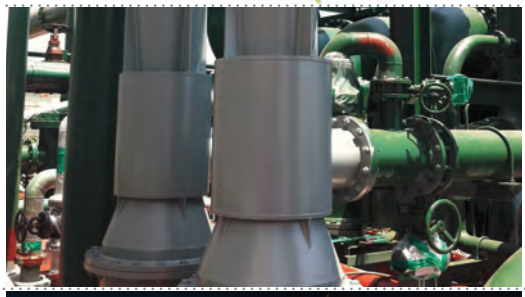

ON THE COVER

Pictured is the Bythotrephes longimanus, more commonly known as the Spiny Water Flea, a species native to N. Europe and accidentally introduced through ballast water into Lake Huron in 1984. Emerging Ballast Water Treatment System rules will potentially cost shipowners millions per ship. MPro presents a look at at the BWTS buying process, a must read that can help you in the selection process.

See story on page 33.

(Photo Source: Michigan Sea Grant; Spiny Flea Information Source: U.S. Department of Agriculture)

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Meet the *Contributors*

Donald MacPherson is an internationally-recognized specialist in applied hydrodynamics with particular emphasis on the design of propulsors and the numerical forecasting of vessel and propulsor performance.

Story p. 8

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Story p. 12

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Story p. 16

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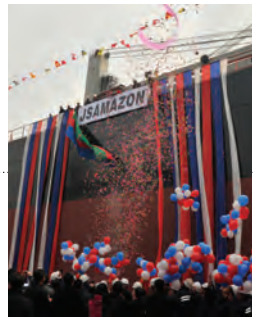
Also in this Edition



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Lead, Follow or Get Out of the Way

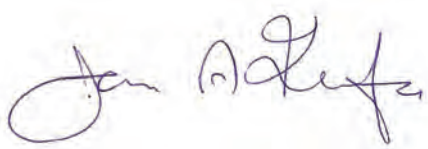
Leadership. That's what this edition of *Maritime Professional* is all about. Yes, I know that the editorial calendar promises news and coverage from the world of classification societies, quality and design. Not to worry; we've got all that covered, and a lot more. On the other hand, when it comes to innovative ship designs, new rules, technology and other groundbreaking advances on the waterfront, we've also discovered that Leadership is the necessary ingredient that makes it all happen. As you make your way through the pages of this edition, you'll discover how, why and what's coming next. Without a doubt, it is an exciting time for operators, shipbuilders and the design professionals that serve them both.

When Shane Guidry, CEO of Harvey Gulf Marine decided to break the mold and bring new, world class tonnage to the U.S. Gulf of Mexico, he could have opted for the safe route. Instead, he's set to roll out the cleanest, most advanced U.S. flag OSV vessels ever seen. Powered by proven, dual fuel Wärtsilä engines, the vessels were meticulously planned from the outset, bringing together a team of industry heavyweights who focused first on safety and then on producing the first U.S. flag vessel designed and engineered completely up front. That's Leadership. It's also a fascinating story.

Halfway across the globe, another example of industry leadership is also producing real results. Our profile and interview with Harald Fassmer, the new Chairman of Verband für Schiffbau und Meerestechnik e. V. (VSM), not only puts focus on the German maritime industry, but also shows us what makes it tick; yesterday, today and tomorrow. Fassmer's leadership of VSM, his own business and his vision for the future provides a clear course line for commercial maritime operations everywhere. Closer to home, the advent of America's newest Product/Chemical tanker, the American Phoenix, evokes talk not just of speed, design and capabilities, but also of a rapidly changing landscape for U.S. energy transport requirements. Delivered with a redundant diesel electric propulsion system and twin propellers, the vessel has the extended maneuverability and stationkeeping needed to meet future shuttle requirements offshore. That's leadership, too.

MarPro's 3Q edition is especially deep with details of new technology, shipping finance, repair strategies and a primer for those operators getting ready to acquire ballast water treatment equipment. And, showing us the way to what will come next, Greg Trauthwein's examination of DNV's bold Shipping 2020 report gives us a glimpse into a shipping world that may experience exponential changes within the next decade.

The details of cutting edge design, far reaching environmental and safety improvements and rare insights into financial mechanics that can all improve even the best operator's bottom line are tightly packaged into this powerful edition. As it all came together, we were reminded that none of it is possible without the expertise and perseverance of maritime professionals – like you, for example. Some might characterize those efforts as the engine of what makes this industry tick. We simply call it Leadership.



Joseph Keefe, Editor | **keefe@marinelink.com**

In This Edition

Insights

"Greener" Ships Through Systems Engineering

By Donald MacPherson

Naval Architect Donald MacPherson's approach focuses on optimizing systems, well before the optimization of individual components.

"Pragmatic hydrodynamics" has long been a core element of the HydroComp brand. Our mission is to provide technical software and consulting services that can be used to confidently determine answers to the big performance questions, such as:

- *How much power is needed to meet a speed requirement?*
- *What are the proper power and gear ratio of the engine and transmission that I need to purchase?*
- *What are the characteristics of a proper propeller for the mission?*
- *What is the nature of a vessel's existing performance, and how can it be improved?*

We answer these questions by focusing on the engineering of an optimized system, before the optimization of components. This sharp attention to "systems engineering" is the direct result of our experience over nearly three decades of involvement with the prediction and management of vessel and propulsor performance.

As most engineers are taught in school, systems engineering is the assembly of various available components to deliver the best system. Unfortunately, in the current revolution that is the "greening" of ship performance, it has been my observation that our industry has lost sight of the system and has become enamored with tweaking components. To consider components before looking at the system leaves a lot of "green" on the table.

The Importance of the System

One of our consulting services is "forensic analysis," helping clients determine why a vessel is not performing as it should. For these cases, we are interested in the propulsion system that is made up of component equipment. It is a most curious thing to listen to the various component equipment builders as they describe the same problem vessel. Each thinks that their component is being unfairly singled out as the cause for the problems:

- *A boat can't make speed? The engine builder says that their component is blamed for not producing the power it should. They are accused of component failure.*
- *Is there excessive noise and vibration at the stern? The propeller builder states that their component is indicted as generating too much cavitation and being no good. This is another perceived failure of a component.*

In all but a few cases, the components are fine. Engines (with exception) produce the power that they claim. Although they are a complex mechanical assembly, each engine is generally evaluated on a test bed before delivery.

Propellers are a single piece of bronze, and have no moving parts. Propeller companies typically have thousands of propellers in service, developed over time by an in-house design staff with years of experience. How bad can the design of a contemporary propeller really be? (It is important to note that there have been, and will continue to be, propeller manufacturing issues for smaller stock propellers that often require the point-of-purchase supplier to inspect and "fair" the propeller. However, this is largely understood today to be a practical reality within the typical delivery process.)

The problems that we see are almost universally with the system – and therefore, the most effective path to achieve "greener" overall ship performance is to start with the system. We need to look past the temptation to acquire the flashiest new component. We already have well-designed components, but they are simply not being assembled properly into a cohesive system that meets the intended objectives of the vessel. Put the initial focus on the system.

So, how do we get the "greenest" vessel in practice (and not in theory)? We need to first lay a solid underpinning of an effective and stable system, one that can take advantage of the best components. From our perspective at HydroComp, there are two principal considerations that lead to solid systems – suitable computational tools and appropriate early-stage design decisions.

Tools for Systems Analysis

It may seem counter-intuitive, perhaps, but some of the newest types of computational tools are actually the least effective in evaluating the system. In days past, we worked with simple charts and looked to prior jobs to make sense of what was needed. We went into the project knowing what worked last time, and then perhaps we pushed the envelope a little bit. The tools were all systems-focused, and provided quantitative answers to fundamental questions:

- *How fast can I go before drag makes operation really expensive?*
- *How much engine do I need to make sure that I can reach the contract speed?*
- *What are the characteristics of the propeller that I need to provide?*

Our HydroComp NavCad software is an example of a contemporary "systems tool" that is elegant, comprehensive, and an accurate way to achieve an understanding of the system and to specify what is needed from the components. It provides the means by which a naval architect can first evaluate the system, and then begin to drill down into the specification of the components.

Appropriate Early-Stage Systems Engineering Decisions

Careful decision-making early in the design process is the other foundation for the "greenest" system. Let me offer two quotes that every naval architect should learn:

"By the time of the first design review, performance, cost and schedule will have been determined to the first order, because all of the critical assumptions and choices will have been made. The really serious mistakes occur in the first day." **[1]**

"Fifty percent of a product's life-cycle costs are determined by the results of the project's first five percent." **[2]**

Put another way, early decisions such as selection of propulsor type (propeller vs. waterjet), hull shape (round bilge vs. hard chine), or stern design (shaft angle, propeller clearance) will lock you into the major cost-drivers and a system configuration. It is during these early system-level investigations that the big vessel design and performance questions are answered:

- *What are my overall efficiencies going to look like?*
- *Do I have enough power to make speed?*
- *What are the implications of shaft angle and propeller clearance on hydroacoustics and noise?*

If these are not carefully evaluated in the first few cuts around the design spiral, then it makes no difference how good a component might be – the system will fail.

Another driver of "green" decision-making is proper expectation of deliverable performance. I cannot tell you how many poorly performing vessels started with someone's unrealistic belief in an achievable vessel speed, in which there was no physical justification to hold these beliefs. Even the most rudimentary system analysis would have exposed that these expectations were unrealistic and unattainable.

Component Optimization

So what about component optimization? While optimization is critical for the "strategic" (product model) design of the component itself, it is not necessarily germane to the "tactical" (right here and right now) systems analysis of a ship design. Don't get me wrong, optimized component design – whether that be the hull, engine, or propulsor – is absolutely crucial to the evolution and improvement of the component itself, and ultimately the system. Given available components, however, proper systems engineering insures that you get the most out of the whole. We are almost always better off with a well-functioning system of good components, than a poorly functioning system of outstanding components.

Let me cite a consulting project from some years ago. This was a classic case where a hull, engine, and waterjet were individually well designed, but they functioned poorly as a system. By improving the interaction of components via modest redesign of the hull and selection of a different waterjet model, the vessel achieved speed with substantially reduced delivered power, fuel consumption, and emissions. A "green" success!

Summary

When seeking the path to "greener" performance, the first step should not be to fine-tune the component. It should be to improve the system, just as we did for the example cited above.

Are you really serious about saving fuel and reducing emissions? Then make sure that the hull, propulsor, transmission, and engine are well matched to the mission and operational profile of the vessel. Improved engineering of the system will provide a greater reduction in fuel and emissions than by optimizing an individual component by a few percent. First, get the system right. Then, and only then, should you look to improve and optimize the system's components. You will be in a much better place to take advantage of what the component designers and builders can deliver for you.

[1] - Eberhardt Rechtin, The Synthesis of Complex Systems, IEEE Spectrum, 1997.
[2] - Business Week, "A Smarter Way to Manufacture", 1990.

The Author

Donald MacPherson is an internationally-recognized specialist in applied hydrodynamics with particular emphasis on the design of propulsors and the numerical forecasting of vessel and propulsor performance. He received his degree in naval architecture and marine engineering from The Webb Institute of Naval Architecture. He can be reached at dm@hydrocompinc.com. On the web: www.hydrocompinc.com

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Insights

Shipping Markets and Finance

By Carl Rasmussen and Harry Ward

In recent years, excess vessel capacity has been plaguing shipping markets and the resultant drop in asset values has restrained financing options for ship owners. Following the financial crisis in 2008, demand across the major shipping segments – dry bulk, tanker and container – has slowly returned, though on an unsteady and often unpredictable path. Increased ton-mile demand (and continued slow steaming) should drive increased charter and spot rates, but the recent recovery in demand has been overshadowed by the vast oversupply of newbuilds delivering into the market, which has kept revenues and earnings too low to cultivate a sustainable recovery.

Rough Seas

Shipping is a cyclical business, highly sensitive to world macroeconomic changes and marked by amplified boom and bust periods. In the 1970's, the industry as a whole experienced two peaks that corresponded with two major oil crises, followed by a prolonged depression in the sector during the 80's. The 1990's were a bit more stable after an early bust in 1993, but experienced the Asian contagion by the end of the decade. A historic surge of demand driven by developing economies in the 2000's brought a huge boom and the Clarksea weighted index of shipping rates topped $46,000 per day in 2008, up from just $12,000 a day at the beginning of the decade. It was this positive cycle late in the last decade that generated excessive new ship orders and caused the current capacity glut after the global downturn in 2008.

In past shipping recoveries, newbuild deliveries were at reasonable levels at or below 6% of global fleet capacity, so charter rates and utilization levels rebounded nicely. After the recent financial crisis and trade recession that brought the Clarksea Index back down to pre-boom levels, however, shipyard output remained strong. According to the 2012 Platou Report, scheduled newbuild deliveries still exceed 11% of existing fleet capacity this year following total fleet growth of 8.2% in 2011. Coupled with anemic world GDP growth, this unprecedented fleet expansion has kept continued downward pressure on charter rates.

The combination of uncertain markets, a tight credit market and the oversupply of vessels has cast a gloom over the shipbuilding industry. Though deliveries continue at a fairly strong rate this year, most shipyards are on course for lean years beginning in 2013. By various estimates, secondhand ship values have dropped as much as 70% while the cost of newbuilds in Asia has fallen by 30-50%. From a high of more than 260 million deadweight tons ordered in 2007, worldwide orders dropped to about 60 million dwt in 2011.

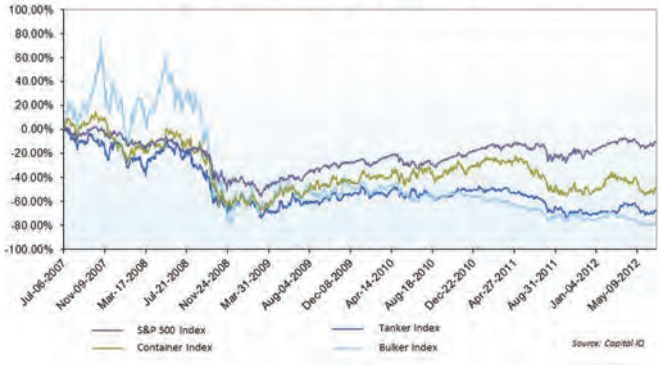
Newbuild Market and Financing

Shipping is a unique industry that remains dominated by private, often family-owned companies with a long history in the business. Banking relationships tend to be long-term partnerships, with debt remaining closely held primarily by European banks. At the peak of the shipping boom in period of 2006-2008, a large number of newbuild and existing ships were financed at high market prices with aggressive capital structures and loose financial covenants. The equity capital markets were booming (Figure 2) and, in combination with the abundance of debt financing on favorable terms, this allowed owners to place big speculative bets that many later came to regret.

As the predominant suppliers of debt financing to the global shipping industry, European banks now have an estimated $500 Billion in outstanding loans, with ~$230 Billion on the balance sheets of the top ten shipping lenders alone. These banks have also been greatly impacted by the European debt crisis and the regulatory changes implemented by Basel III. Whereas these banks may have access to their national currency (whether EUR, GBP, SFr or NOK) at fairly competitive borrowing rates, they have substantially higher borrowing costs in USD, the standard currency in the global shipping industry.

Basel III has the added effect of requiring banks to set aside a larger percentage of regulatory capital against their loan books, as well as to match fund the term of their loan commitments. A critical impact of Basel III will be that the banks will have to apply more capital to their existing loan portfolios and therefore have less capital available to make new loans. The match funding issue means that banks have to price their actual USD term liquidity costs into the margins that they charge over Libor. Libor funding is a shorter term financing market and does not match the term funding commitment provided by lenders.

Figure 2: 5-Year Shipping Sector Stock Indices



> "The combination of uncertain markets, a tight credit market and the oversupply of vessels has cast a gloom over the shipbuilding industry. Though deliveries continue at a fairly strong rate this year, most shipyards are on course for lean years beginning in 2013. By various estimates, secondhand ship values have dropped as much as 70% while the cost of newbuilds in Asia has fallen by 30-50%."

Future Funding Scenarios

Several high profile banks have decided to reduce their exposure to USD funding needs and have decided to exit ship lending entirely, leaving some unanswered questions. Other banks have scaled back their ambitions and are only there to support their existing customer base. The global shipping industry requires substantial equity and debt capital to take delivery of the existing orderbook of vessels and refinance debt facilities as balloon payments become due. Where will this money come from?

Though Private Equity firms have shown an interest in shipping companies and assets recently, there is certainly no clear path for them to get guaranteed returns of 25% (preferably risk-free) based upon current ship values and charter rates. A few PE firms have actually stepped up and made investments but the jury is still out as to whether more will follow.

To entice new orders, shipyards have significantly lowered contract prices and are offering attractive payment terms. The stronger shipyards appear to have a degree of financial support from their domestic export credit agencies (ECAs) which have stepped up their efforts and have been generally supportive of their own domestic shipbuilding industry. The ECAs will support their domestic shipyards by financing the shipyards' working capital needs that are heightened by the heavy tail payments at delivery.

Most shipowners are having a difficult time raising pre- and post-delivery financing for newbuilds from the lenders who have remained open for business. But with shipyards reportedly only requiring a total of 20-30% in payments prior to delivery, shipowners interested in placing orders today can effectively fund these payments with equity. The ECAs have stepped up and can either provide post-delivery loans directly to the shipowner or guarantee that the principal and interest on the ship loan is repaid in the event of a default by the shipowner. ECAs are active but are unlikely to be able to fill the void left by the exodus of lenders from the ship finance industry.

Will the ECAs, Asian banks and US banks fill the void left by the departing European lenders? As long as the global shipping markets remain a USD industry, it will be hard for the ECAs and Asian banks to fill a major portion of the impending funding gap as they too have USD funding issues. They will likely play a bigger role in providing ship financing going forward but will not solve the looming debt shortage. The big US money center banks could get more involved provided that the margins are high enough to earn attractive risk adjusted returns. These banks are mainly yield driven and have full access to USD funding but will only be interested if the yields that they can achieve are attractive relative to the rates they can charge for alternative deals in other industries.

Finally, will a market develop for structured shipping debt products such as securitization or covered bonds? Investors who might buy this paper would require rating agencies to assign investment grade ratings to shipping assets which may be a real stretch given that the rating agencies are not fans of the volatility in ship values and earnings.

Some Positive Signs

Despite the numerous troubles in shipping and ship finance, there are some bright spots. Specialized niches such as LNG carriers and offshore energy operators are thriving. Available LNG carriers are earning record rates in today's market. Recent General Rate Increases (GRI's) on certain containership routes have shown success, and overall global trade is expected to grow at a rapid rate over the next 15 years. The rapid taper in newbuild orders, though troublesome for shipyards, should also bring capacity utilization and charter rates back in line over time. And though financing remains tight in the sector, the overall low cost of capital and bottoming asset prices will create opportunities for bold investors in the next few years.

The Authors

Carl Rasmussen is a Senior Vice President / Senior Relationship Manager at HSH Nordbank AG in New York, one of the world's leading financial service providers to the global shipping industry. He is a US Merchant Marine Academy graduate and earned an MBA from Tulane University.

HSH NORDBANK

Harry Ward leads the transportation and logistics practice at The McLean Group, a middle-market investment bank based in the Washington, DC area. He is a US Naval Academy graduate and earned an MBA at San Diego State University.

The McLean Group INVESTMENT BANKING

Insights

Getting Ahead with EEDI: BV Provides Guidance

By Bernard Anne,
Managing Director of Bureau Veritas

IMO's Energy Efficiency Design Index is intended to improve energy efficiency of ships at the design stage. It will be mandatory for new ships contracted for construction or major modifications after 1 January, 2013 or delivered after 1 July, 2015. Forward looking shipyards need to gear up for that change now and have designs ready which will give ships a competitive edge in a market where energy efficiency will matter more than it has for a long time. Bernard Anne, managing director of Bureau Veritas' Marine Division, weighed in recently with MarPro on the best way forward.

Anne reported to ***MarPro*** in July, "The better yards and owners are looking beyond today's difficult times and preparing for the next generation of vessels. They will be defined by two issues; the implementation of the Harmonized Common Structural Rules and energy saving. That is why it is important for class to be fully up to speed with all the changes that harmonizing the common structural rules will bring in, and also to be able to advise yards now on the EEDI of new designs. Our attestation of the EEDI performance of new designs will help give yards and owners confidence in ordering new tonnage."

Timelines and Deadlines

The interim guidelines for voluntary certification of the EEDI (MEPC 1. Circ. 682) allow new designs of ships contracted before the above date to be verified against the EEDI, provided that all rules and criteria of MARPOL Annex VI are strictly and fully verified. These include model tank test, sea trial measurements and results, light weight and displacement checks and the correct calculation methodology.

Earlier this year Bureau Veritas issued its first attestation of compliance with EEDI to the ultramax geared bulk carrier JS Amazon; the lead ship in a new generation of CROWN63 vessels developed by China's Sinopacific Shipbuilding Group with the bulk carrier expert Setaf-Saget.

The 63,300 dwt vessel is designed for the carriage of bulk cargoes, including coal, iron ore, grain and cement, as well as a range of dangerous cargoes. Its GHG (Green House Gas) performance when measured in accordance with IMO's Energy Efficiency Design Index is twenty percent better than the requirement under MARPOL Annex VI and already reaches the Phase II requirement set for the years 2020/2024. Its deadweight was achieved as a result of an advanced design fully compliant with the Common Structural Rules. The vessel can carry 5.2 per cent more cargo than other bulk carriers of comparable size.

Says Anne, "This vessel marks the start of a new series of ships which will be exemplary contributors to a greener and cleaner world; shaping the future image of shipping. It also represents a celebration of the achievement of outstanding new design concepts and the re-enforcement of strong and successful, long-established levels of cooperation. Bureau Veritas, Sinopacific Shipbuilding Group and bulk carrier expert Setaf-Saget have been working together for many years in the best kind of partnership – one built on trust and a long-term commitment to shipbuilding quality and innovation. BV has been delighted to work with Greenseas, the in-house design office of the Sinopacific Group, which has a proven ability to deliver high-quality designs for energy-efficient ships."

EEDI Specifics

Energy saving in the Crown 63 design was achieved by introducing an enhanced hull form, fitting an electronically controlled main engine driving a larger and slower running propeller and the fitting a rudder with an advanced profile. A rudder bulb is also fitted, studied together with a propeller cap to produce the most effective aft water flow.

The hull form was developed in close cooperation with the German HSVA model basin and five test campaigns were performed over eighteen months to achieve the final lines. Particular attention was paid to the bow and stern lines to achieve good flow lines and minimum wake. Particular attention was also given to the manufacturing tolerances of the propeller. Built by Nakashima in Japan, it was manufactured to the strictest of tolerances to ensure it delivered the specified performance.

The MAN B & W 5S60ME-C8.1 Tier II x 1set ME electronically controlled engine was selected because it delivers lower specific fuel consumption over a wider range of operating parameters (bed test value at NCR: 161.6 g/Kw) and improved emission characteristics with lower NOx and smokeless operation. It runs easily at lower RPM for maneuvering and gives better acceleration, astern and crash stop performance. The NCR (normal continuous running) is fixed at 80 per cent MCR, which gives the master an important power reserve available to face deteriorating weather conditions. Full rated continuous running delivers 8,300 kW at 91.0 r/min. Normal operational continuous running delivers 6,640 kW at 84.5 r/min, giving a service speed of 14.5 kt consuming 28.5 tpd.

Compared to typical similar size ultramax designs the combination of increased deadweight and increased fuel efficiency reduces the loaded fuel consumption per ton mile per day by almost 20 per cent. But that is not at the expense of safety.

"The power reserve is crucial," says Anne. "It would be easy to design ships which give a good EEDI figure but which are underpowered and so unsafe. We have to ensure that ships have the power they need to stay out of trouble in high winds, so this arrangement is the way forward, giving the master some back-up power for times when he really needs it."

Earlier this year Bureau Veritas issued its first attestation of compliance with EEDI to the ultramax geared bulk carrier JS Amazon; the lead ship in a new generation of CROWN63 vessels developed by China's Sinopacific Shipbuilding Group with the bulk carrier expert Setaf-Saget.

EEDI is More Than Possible: It is here

According to Anne, "EEDI is aimed at producing ships which are ahead of industry standards, with optimized fuel consumption and the highest standards of quality and safety to meet the demanding criteria for bulk carriers engaged in worldwide service today. The CROWN63 series demonstrates to the shipping industry, and to the world, that the shipping and shipbuilding industries can bring to the market an exemplary generation of new ships which are safeguarding the future of our planet."

The vessel's deadweight of 63,200 tons on summer draft - the maximum possible achievable deadweight compatible with the requirements of the CSR rules, within the length and draft - was obtained thanks to refined steel structure calculations. Anne says that BV has invested heavily in leading the IACS project to harmonize the Common Structural Rules and invested internally to update its VeriSTAR Hull and MARS structural analysis tools to be ahead of the new implementation. "That gives us both the understanding we need to guide yards in how the rules will work, and the tools to verify quickly and clearly that proposed new designs will meet the rules. It is crucial that yards don't get carried away with efficiency and forget safety and rule compliance. We have to make the vessels are efficient, but first we have to make sure they will be safe and future proof for the harmonized rules," he emphasized.

Looking East for Cost Savings:

Horizon Line's vessel modifications bring light to an interesting and somewhat mysterious equation. MarPro takes a closer look.

By Barry Parker, bdp1 Consulting Ltd.

Jones Act rules are tricky, but a close reading (and interpretation) can yield savings for cash-strapped shipowners. Around the time of the Q1 2012 earnings season, Horizon Lines, battered but still trading over the counter, revealed in a regulatory filing: "During 2012, we expect to spend approximately $24.0 million and $18.0 million on capital expenditures and dry-docking expenditures, respectively. Such capital expenditures will include vessel modifications, rolling stock, and terminal infrastructure and equipment." Most importantly, it offered that: "We have commenced our plan to dry-dock three of the vessels utilized in our Puerto Rico tradelane in China during 2012. Despite the significantly higher transit costs to get to Asia, we expect these dry-dockings will enable us to make high quality cargo modifications and other enhancements to our core Puerto Rico fleet that will be instrumental in ensuring service integrity for our customers."

No other detail is provided, forcing analysts into the realm of rough estimations in trying to re-cast the economic calculations made by planners at Horizon Lines. The business case compares two costs. The cost of putting the vessels into a U.S. yard (likely in the U.S. Gulf or Atlantic Coast), involves a small deviation, plus the costs of the requisite yard work. The Far East alternative involves a lengthy and non-remunerative transit to China (plus the costs and additional out of service time on the return leg), the expenditure on the actual work, and a customs duty (50% of the cost of the work).

This revelation of the upcoming Chinese dockings, buried deep within its 10-Q (a quarterly report), highlights an issue that has featured in recent dialogues about the cabotage side of the Jones Act. The vessels in Horizon's Puerto Rico trade are old; its service is handled by four ships of between roughly 1400 and 2200 TEU, built from 1968 to 1974. The announcement's hint of "modifications" points the discussion toward the Jones Act's "Second Proviso", a set of regulations stemming from a group of bills initially enacted in 1956, at the urging of U.S. yards, after owners of U.S. built Jones Act vessels had modified them abroad. After further amending legislation in 1960 and 1988, the latest "Rebuild" language was inserted in the Code of Federal Regulations (at 46 CFR 67.177) in the mid 1990s (after the 1988 language was overturned in a District court case).

A Look at the Rules

Essentially, the rules look at the weight of foreign steel work compared to the vessel's lightship weight prior to the work; less than 7.5% is allowed, between 7.5% and 10.0% may be allowed (at the discretion of the U.S. Coast Guard), and anything above 10% is not allowed. A second test involves the addition of a "Major component" which is subject to a ceiling of 1.5% of the pre-work lightship weight. In recent years, foreign work on a number of Jones Act vessels has fueled controversies around these rules. The roster of challenges include work done on Matson Lines' containership Mokihana, and questions surrounding a flock of OPA-related tanker cases: Seacor's Seabulk Trader and Seabulk Challenger (both still trading after double hull retrofits in China), Keystone's Delaware Trader, and U.S. Shipping's Philadelphia and New York.

Most recently, in March, 2012, the Coast Guard rejected a petition filed 14 months earlier by an adhoc coalition that included various organizations and Jones Act owners (including Horizon Lines). This group had petitioned to change the wording of the statutes regarding foreign yard work. The petitioners, who had represented diverse and opposing viewpoints, sought to clarify "…what types and amounts of foreign shipyard work on vessels are and are not permissible under the Jones Act." The group noted that the greatest confusion surrounded the precise rules and definitions in the application of the "Major component" test. The Coast Guard's decision not to revisit the CFR rules (http://www.gpo.gov/fdsys/pkg/FR-2012-03-20/html/2012-6588.htm) cited a trail of legal cases that had fashioned what it said was a clear understanding of the rules- labeled as ambiguous by the 12-member coalition. The Coast Guard also pointed to the minefields surrounding proprietary commercial data that might be revealed in the inevitable legal dust-ups that ensue after owners submit confidential information supporting determinations on rebuilds.

The Numbers

Horizon Lines' estimated drydocking expenses for 2012 will be in line with historical numbers. In 2010 and 2011, Horizon Line amortized $15.0 million and $15.4 million, respectively, for drydocking on its income statements, based on a thirty month cycle. Actual drydocking payments (for an average of six vessels/ year) have ranged from $12.5 million annually (2011) to $19.1 million (2010) in recent years.

The real "savings" for Horizon Line, searching every crevice of its operations for liquidity, will come from the capital investments on the vessels, probably in the range of several million dollars, each. Domestic yard work is more expensive than work done in Asia. What isn't crystal clear is how much more expensive that domestic work is. Given the extra time and expense to send vessels half way across the world for refurbishment, one has to assume that it is very substantial.

A rough proxy for the order of magnitude differential in the

price of yard work can be seen from variations in newbuild vessel prices. The cost of a newbuild "Aframax" tanker in an Asian yard was estimated variously by brokers at around $60 million at roughly the same time that reports pegged the price tag of two SeaRiver vessels to be built in a leading U.S. yard at around $200 million, each. The cost of a foreign built Aframax is now estimated to be under $50 million.

Exact capital budgets are closely guarded (note the Coast Guard's wording in their denial: "*... virtually all applicants consider the information submitted to the Coast Guard in connection with requests for foreign rebuild determinations to be highly proprietary"*), but planners likely evaluated the capital cost savings against the incremental cost of positioning the vessels to Asia. This would include the not-so-insignificant extra round trip transit time on the order of six to seven weeks (compared to repositioning into a U.S. yard) that would also give rise to additional fuel costs, Canal transit expenses (each Panama transit could be on the order of USD $150,000 to $200,000), as well as the out of service time. However, in the planners' calculus, these costs were outweighed by the capital cost savings, where the price tag on domestic work would be at a multiple of that done in a Chinese yard.

Analysis: And a Look Ahead …

Horizon Lines has been through a massive balance sheet restructuring. After dodging numerous financial bullets, management of cash flows is crucial.

Earlier this year, it announced that it had agreed with debtholders, and with Ship Finance Limited, on the elimination of $188.4 million, net, of debt. Its CFO, Michael T. Avara, had said: "The significant deleveraging resulting from these transactions greatly improves the Company's cash flow and liquidity, allowing for greater financial flexibility and stability."

Careful navigation around the "Second Proviso" will be imperative in Horizon Lines' quest for smoother sailing as the carrier performs work that includes modification of holds and hatches for carrying both conventional and reefer boxes.

Looking beyond things like cell guides and brackets, the strategy here points to the broader issue – work in domestic yards costs substantially more than doing work in foreign yards, even after not-insubstantial positioning and repositioning costs are considered. In these tough economic times, other Jones Act owners will likely be looking closely at how Horizon Lines fares.

Interview

Harald Fassmer – Chairman, VSM

By Peter Pospiech

Harald Fassmer is the new Chairman of Verband für Schiffbau und Meerestechnik e. V. (VSM), the German organization representing the country's political and commercial maritime industry interests. Mr. Fassmer also happens to be a ubiquitous figure in the international maritime circuit, serving as executive partner at Fr. Fassmer GmbH & Co.KG. In May, former VSM Chairman Werner Lüken handed over the reins to Mr. Fassmer, and here – on the occasion of SMM in Hamburg – he shares with Maritime Professional's Peter Pospeich insights on the future direction of the German Maritime industry.

The 48 year old Harald Fassmer, Managing Director of the family-owned enterprise shipyard Fr. Fassmer GmbH & Co. KG, has been elected as Chairman of the German "Verband für Schiffbau und Meerestechnik, VSM, e.V"

FIRST OF ALL, CONGRATULATIONS ON YOUR APPOINTMENT AS CHAIRMAN OF VSM. ALREADY A MEMBER OF THE VSM STEERING COMMITTEE, AND AS SUCCESSFUL BUSINESSMAN IN YOUR OWN RIGHT, WHAT LED TO YOUR APPOINTMENT AS CHAIRMAN?

The steering committee asked if I want to take over the assignment as a Chairman for the next cycle. I'm looking forward into this additional assignment and I'm honored with the confidence that has been placed to me.

IN GERMANY, WE HAVE A SAYING: "A NEW BROOM SWEEPS CLEAN." WHAT WILL BE YOUR FIRST AND MOST IMPORTANT ACTIVITY?

Our previous Chairman, Mr. Lüken, has represented the interests of the Association in an excellent manner and I hope that I can do this in the same way. Your adage saying "a new broom sweeps clean" is therefore not appropriate. Nevertheless, we are seeing a permanent change of the political and economic framework. Therefore, the concerns of VSM have to be adaptable. That's because VSM represents the political and commercial interests of the German maritime industry, comprising shipyards building oceangoing and inland waterway vessels as well as marine equipment suppliers, classification societies, ship model basins and engineering consultants. The responsibilities of the association include providing members with specialist advisory and support services and representing their interests in public and vis-à-vis political institutions. The VSM also promotes technical and commercial development in the shipbuilding and ocean industry in Germany and abroad. The Association represents its members nationally and internationally. VSM is a member of BDI (Bundesverband der Deutschen Industrie e. V.), the German Society for Maritime Technology STG (Schiffbautechnischen Gesellschaft), the European shipbuilding organization CESA (Community of European Shipyards' Associations) as well as the association of equipment manufacturers EMEC (European Marine Equipment Council).

DURING THE VSM GENERAL ASSEMBLY IN HAMBURG, YOU ALLUDED TO "MASTERING THE CHALLENGES IN THE CONSTRUCTION OF SPECIAL-PURPOSE VESSELS." WHAT DOES THAT ACTUALLY MEAN AND HOW DO YOU GO FORWARD?

In spite of existing problems, shipbuilding and marine technology in Germany are well positioned in a European comparison and form the basis of a maritime growth strategy. This is essential for overcoming maritime targets, ranging from green shipping to regenerative energy supply, particularly in the field of offshore wind energy. Numerous challenges remain. More difficult financing options, caused by the increase in equity capital requirements and unwillingness by banks to accept new risk lead to considerable problems in ship financing. Therefore, functioning financing instruments are essential. For example, this involves the necessary adaptation and expansion of export credit insurance and federal state guarantees. The legal requirements for ship safety as well as marine environmental and climate protection pose additional challenges. With the implementation of new environmental standards, economic

A Fassmer build 65m Offshore vessel "Fugro Searcher"

incentive systems and direct, practice-orientated supporting measures should be provided. With special-purpose vessels, offshore platforms and structures, as well as the development of clean and energy-efficient technologies, the structural change in the German shipbuilding industry is on the right course. The current keywords, 'green shipping' and 'blue growth', stand for real growth prospects, if these are dealt with across industries, segments and countries using concrete measures. However, improvements in the framework conditions are essential for this, in order to bear up to the tougher competition,

Fassmer build Greenpeace "Rainbow Warrior"

which is being triggered by the aggressive acquisition policy, particularly in Korea and China. The unbridled expansion of construction capacities by both countries far exceeds the medium and long-term demand for new ships with the consequence that the Asian competition is also trying to penetrate the niche markets of special-purpose vessels. Furthermore, extensive support programs are being established far more intensively in Asia than in Europe. In order to counteract this, we need an offensive industrial policy strategy, industry-appropriate framework conditions and particularly the goodwill and willingness to cooperate with participants in Germany and the EU.

WHERE IS THE GERMAN MARITIME INDUSTRY SUCCEEDING, AND MORE IMPORTANTLY, WHERE CAN IT IMPROVE?

German Shipyards, ships and maritime suppliers align their product portfolio almost exclusively on the building of high tech special ships and competencies. Industry relies on existing professional competence and the innovational strength of their employees and focused on further personnel progress. The restructuring of the German shipbuilding industry requires these merits and a substantial upgrade of engineers; in terms of both quality and quantity. Beyond this, shipyards changing production from series-build into single and small-series production of special purpose vessels require a much higher number of engineers. It is for these reasons that, for our member companies, the term "shortage of skilled labor" is not a political phrase, but a real challenge in the effort to increase German industrial competitiveness. German repair yards have diversified their activities, expanding into power plant construction, for example, to generate new market segments. The repair and maintenance of naval and government vessels is also an essential linchpin of the domestic market.

The move toward emissions reduction and the increasing fuel prices offer the opportunity for renovations and upgrades to the efficiencies, as well as environmental protection technologies. All represent a strong demand potential. Ballast water treatment, emission control systems and other fuel saving

> "The slump in demand, difficult financing conditions and low construction prices created a problematic environment and required further structural adjustments."

technologies belong to this. German repair yards are equipped with enough capacity to carry out the necessary modification works on time. In terms of location, German shipbuilding is well positioned.

With well-developed infrastructure, good leadership and a well-educated staff, the relatively high labor costs nevertheless remain an issue. The current overcapacity in the market and a lack of trained engineers also weigh on the sector.

HOW WILL THE GERMAN SHIPBUILDING INDUSTRY POSITION ITSELF FOR THE FUTURE? WHERE DOES IT FIT INTO THE GLOBAL SCHEME?

Although the commercial shipbuilding markets account for as much as 80 percent of global shipbuilding output – containerships, tankers and bulkers, for example – this will not be the focus for German shipbuilders. Our focus must be on the remaining 20 percent of the market, represented by special purpose vessels. Nevertheless, this challenging but also profitable market will be a future target for Asian shipyards. Beyond the special purpose vessels, however, offshore technology also becomes more important. Here, German companies must position themselves as soon as possible. The same holds true for the maritime environmental protection, which will include the repair, the modification and the upgrade of existing ships.

Despite the current economic slowdown, the world's merchant fleet will nevertheless grow in the long run. Repair capacity therefore remains important as both seagoing and inland shipping must be prepared to meet the coming environmental requirements, not only on new ships but also with existing fleets. We have to take advantage of this.

FINALLY, A LOOK AHEAD TO THE UPCOMING SMM INTERNATIONAL TRADE FAIR LEADS US TO ASK YOU WHAT MAJOR FOCUS – FOR THE GERMAN

Fassmer built OPV 80 BCC

SHIPBUILDING INDUSTRY AND FOR YOUR OWN ENTERPRISE – DO YOU SEE AT THIS TIME?

At this year's 25th Jubilee, SMM once again shows why it is the world's leading trade fair of the maritime economy and maritime sector. What does SMM offer in 2012? Innovation, products, analysis of performance and trends – all presented by more than 2,000 exhibitors from over 60 countries on more than 90,000 square meters of floor showspace. More than 50,000 professional visitors from around the world are expected.

International conferences and congresses on current issues will complete the show. And, do not forget the integration of the international conference for maritime Safety and Defencepolitics (MS&D).

With this, SMM visitors get an overview of the newest technologies during the four day duration of the show. We, Fassmer Shipyard, as an exhibitor, will present at this venue and we look forward to interesting conversations.

Where & What Will Your Tanker Trade ... and Why?

By Robert Kunkel

Watching the bottle break across the bow of the latest U.S. Flag Product/Chemical tanker American Phoenix during the June 30th christening ceremony was an exciting event. The completion of the vessel was a result of many hard months of work for hundreds of U.S. workers, superintendents and engineering firms throughout the country. New Construction ceremonies usually result in discussions of design, ship's speed, consumption and main engines. What made the American Phoenix delivery particularly interesting was the preparation for her first domestic oil cargo, leading to a discussion about the changing patterns of the oil trades.

Shifting Patterns

One of George W. Bush's many famous quotes guided us to the discussion "It is clear our nation is reliant upon big foreign oil. More and more of our imports come from overseas". An amusing statement; perhaps no longer true and leading to new opportunities for the U.S Domestic tanker fleet.

U.S. crude oil import patterns have shown significant shifts in recent months. A movement towards tight oil production from the Bakken formation in North Dakota and elsewhere has helped displace imports from some of the countries historically providing our energy sources. U.S. crude imports dropped approximately 94,000 barrel per day (bpd) or about 1 percent from the first quarter of 2011 to the first quarter of 2012. New sources of North American crude supply along with shifts in the depth of offshore exploration, geographic distribution of U.S. refining capacity and a startling explosion of shale oil production in the U.S. are all changing the North American petroleum marketplace. These changes are redrawing the pattern of U.S. crude imports and in turn are affecting domestic and foreign tanker transportation.

The river of new light oil from the Bakken formation in North Dakota, southern Alberta and Saskatchewan, as well as the Eagle Ford formation in Texas, is now about one million barrels per day and, reportedly, set to double over the next few years. The most important development in U.S. crude oil import patterns continues to be the rise in flow from Canada into the Midwest. Thanks to continued production growth from the oil sands of Alberta, Canadian crude now accounts for virtually all of Midwest crude imports reaching an average of 1.76 million barrels per day in the first quarter of 2012. A 323,000-bbl/d (22-percent) increase from a year ago, according to the latest data from the U.S. Department of Energy. In the United States as a whole, first-quarter Canadian crude imports rose by 315,000 bpd year-over-year.

Looking aft on deck of American Phoenix. A pot of Gold under the rainbow?

The U.S. imports 6.3 million barrels of foreign oil every day (excluding Canada), while it consumes 18.2 million barrels on the same daily basis. The Energy Information Agency expects U.S. oil imports to drop by 20% by 2025. And, British Petroleum has estimated the U.S. will produce 94% of its energy domestically by 2030, increasing from a 77% production rate now. Citigroup along with many others project the U.S. may be able to achieve energy independence by 2020. All in all, this points to a smart move by Alterna Capital and Mid Ocean Tanker Company (the owners of the American Phoenix), to deliver the most advanced IMO II Chemical/Product tanker under U.S. flag into a market place that looks to be developing new routes of domestic oil transportation.

And that is where the opening commercial negotiations became interesting.

Enter the American Phoenix

Outfitted for aggressive chemicals and originally (prior to the recent recession) designed in 2007 to carry larger capacities of light petroleum products into Florida, American Phoenix' first cargo may very well be domestic crude oil with an API Gravity of 55 traded within the U.S Gulf. The gusher of new domestic oil production coming out of shale deposits in North Dakota, Texas, and Oklahoma has outstripped the country's pipeline capacity to move crude to the areas it needs to be. The result is an oversupply built up in the middle of the country, lowering the price of West Texas Intermediate. Refineries along the Gulf Coast would love to get their hands on more cheap domestic crude and ships like, for example, the American Phoenix may provide that love.

The new patterns of domestic crude oil may not end there.

Deepwater GOM

U.S Interior Secretary Salazar testified before the Senate Energy Committee in February of 2012 that oil production from the Federal Outer Continental Shelf has increased by 30% since 2008 and grew to an estimated 589 million barrels in 2010. The fact is the number of oil and gas drilling rigs active in the United States exceeds that of most of the rest of the world. At the end of 2011, there were 1,981 rigs actively exploring for oil and natural gas in the United States. "Offshore" has a new meaning considering the depths and locations where this exploration takes place. The long promised requirement for U.S. Flag shuttle tankers to collect these new fields and deliver the oil to the Gulf Coast refineries may have

> "... this points to a smart move by Alterna Capital and Mid Ocean Tanker Company (the owners of the American Phoenix), to deliver the most advanced IMO II Chemical/Product tanker under U.S. flag into a market place that looks to be developing new routes of domestic oil transportation. And that is where the opening commercial negotiations became interesting."

finally arrived. Delivered with a redundant diesel electric propulsion system and twin propellers, vessel has been provided with the extended maneuverability and stationkeeping needed to meet future shuttle requirements offshore.

Natural Gas and chemicals, too

No report on domestic energy would be complete without a mention of natural gas. Prices have dropped by around 40 percent in the last year due to excess supply of the fuel in the United States. The reason for this is excess supply and the technological advancement of shale gas extraction through hydraulic fracturing and horizontal drilling in the past few years.

Access to new supplies of domestic shale gas, rich in the ethane needed for chemical production, is revitalizing the chemical industry and America's manufacturing base. American chemistry relies on affordable natural gas as a source of energy and as a raw material, or feedstock, to make the chemicals that go into nearly 96 percent of all domestic manufactured goods. A recent industry study confirmed an increase of 25 percent in ethane supplies from shale gas could create 400,000 new jobs in the chemical and supplier industries.

New supplies of natural gas from previously untapped shale deposits are one of the most exciting domestic energy developments of the past 50 years; a game changer when coupled with the growth and competitiveness of U.S petrochemical manufacturers. The shift toward lower-cost natural gas has resulted in greater competitiveness and export demand for U.S manufactured chemicals. That rebirth and demand will lead to an increase in domestic chemical transportation.

Historically, the largest Jones Act bulk chemical movements have been Paraxylene and Ethanol. The movements have not supported period charters of chemical tankers the size of the American Phoenix as cargo lots tend not to exceed 150,000 barrels.

Other chemicals, moving under contracts of afreightment in smaller stems include caustic soda, glycol, tetramer, cumene, styrene, and lube oils shipped by ATB. The American Phoenix has been built with stainless steel piping systems and International Paint cargo tank coatings capable of transporting a myriad of chemicals. Hence, she is arguably well positioned to take advantage of the projected growth in the domestic chemical industry and a return to manufacturing in the United States.

American Phoenix: the magic moment. Jill Stagg is a representative from Koch Oil, the charterers.

American Phoenix, dressed for christening.

American Phoenix at sea

Gas as Fuel: Me, too?

That is not the end of Mid Ocean Tanker's gas discussion. Prior to departing the shipyard the American Phoenix was surveyed by Waller Marine of Houston, Texas and Alternative Marine Technologies of Stamford, CT to determine if the MAK diesel electric generators and the surrounding machinery spaces could be modified to utilize LNG as a propulsion fuel. The ship's first drydocking may also develop into an interesting discussion. Mid Ocean Tankers and Alterna Capital Partners have a good start with the successful build and maiden voyage of the 49,600 DWT, Diesel Electric Chemical/Product tanker American Phoenix. Like the markets it will eventually ply, it is likely that the vessel will eventually see many changes; inside and out.

The Author

Robert Kunkel is President of Alternative Marine Technologies. A past Vice President of the Connecticut Maritime Association, he is also Technical Manager for Coastal Connect www.coastal-connect.com.

HIGH SEA TECHNOLOGY

High Availability on the High Seas:

ETHERNET Controller helps Shipbuilders Meet ABS Network Redundancy Requirements

Safety-critical tasks place exacting demands on the performance, capability and availability of shipboard controls. Thus, the American Bureau of Shipping (ABS) requires network redundancy. If a wire breaks, triggering one network/server to fail, a redundant network becomes an additional communication path to provide uninterrupted operation. Historically, network redundancy has required extensive wiring and additional control components, which increases shipbuilding and maintenance costs. Now, ETHERNET-based programmable controllers are cost-effectively streamlining shipboard control via innovations in network redundancy.

Darryl Felder, Project Engineer for Baton Rouge Marine Electrical Service, Inc., employs advanced controllers, such as WAGO Corporation's 750-882 ETHERNET 2.0 Network Redundancy Controller. 750-882 supports redundancy by simultaneously interfacing two ETHERNET-based networks. Felder is integrating 750-882 into a steering control project that requires network redundancy. Traditionally, two complete control nodes and an extensive multi-conductor infrastructure would be used. However, Felder sought the efficiency of 750-882's two-cable architecture for streamlining data collection from the ship's positioners.

Built-In Redundancy

"With the 750-882, you only need to run two cables, not 160 wires," Felder said. "Redundancy is required — if you were to lose one cable, you'd lose all of the steering." Felder insists that 750-882 could run ballast control and bluewater applications alike. The 750-882 carries ABS-Type approval, well as KR, GL and DNV Marine Certifications.

"750-882 makes it a whole lot easier to meet ABS requirements," he explained. "With 750-882, you don't need that second complete control node — it already has redundancy." Because 750-882 requires just two cables, it reduces installation and maintenance expenses Felder said — no troubleshooting and tightening/retightening 160+ wires. 750-882 also reduces the control footprint for shipbuilders and system integrators. Using a previous ship lighting control project — which did not require network redundancy — Felder illustrated the impact of one redundant controller.

"If it were to require a complete second node for redundancy, about 25% more enclosure space would have been needed," he estimated.

ETHERNET Comes Aboard:

750-882 hails from the WAGO-I/O-SYSTEM, which withstands magnetic fields, continuous vibrations/shocks, humidity and temperature fluctuations. With approvals from Germanischer Lloyd, Lloyd Register of Shipping, the American Bureau of Shipping, Nippon Kaiji Kyoka, Bureau Veritas, Det Norske Veritas and RINA, the system is certified for marine control. Felder himself has employed WAGO controllers and I/O modules for tasks such as wheelhouse monitoring.

A manufacturing mainstay, "distributed" ETHERNET-based control is gaining acceptance over conventional fieldbus solutions for marine applications. One of the reasons: flexible and open communication via standardized ETHERNET infrastructure. Also, Felder said, several shipping and petro firms utilize ETHERNET onshore. "These customers are already using servers that read ETHERNET-compatible communication protocols such as MODBUS/TCP," he rationalized. "No additional servers or software while using existing networks and security measures, e.g., firewalls, saves a substantial amount of time and money."

Another reason ETHERNET is gaining favor in shipbuilding: multi-client/server architecture that permits redundancy mechanisms while increasing availability. Redundancy is traditionally provided by duplicating both components and lines. Errors such as wire breaks no longer lead to control system failure, since alternative components or network connections are available. Cost-effective and compact, redundant network controllers provide shipbuilders with several benefits. These include advanced data transmission technologies that make high levels of component availability and safety possible.

Redundancy Procedures

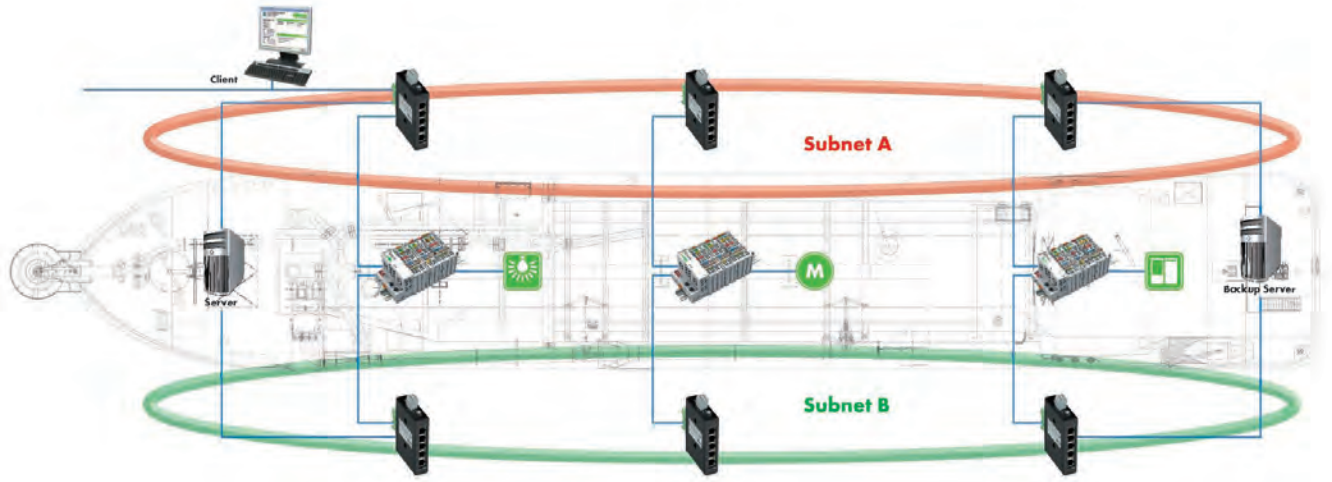
To increase communication network availability, different redundancy procedures for ETHERNET-based networks are available, such as the Rapid Spanning Tree Protocol (RSTP) [IEEE 802.1D-2004], Media Redundancy Protocol (MRP) [IEC 62439-2], Parallel Redundancy Protocol (PRP) [IEC 62439-3] and others. A prerequisite for these, however, is that the ETHERNET network contains no closed loops or rings. Redundancy procedures open and close the loops or rings depending on the specific requirements.

RSTP: used in complex network topologies to disable redundant paths. When a link failure occurs, RSTP determines the best paths via communication costs (telegram propagation times) and priorities, while reactivating the required paths. The switch-over time required for RSTP ranges from 1–3 seconds.

MRP: used in a ring topology in which a central switch (Master) closes the ring in case of a network failure and reopens it once the failure is corrected. The switch-over time required for MRP is between 200 and 500 milliseconds.

PRP: communicates via two parallel networks, while transmitting telegrams simultaneously over both networks. Replicated telegrams are discarded by the receiving nodes, providing virtually switch-over-free redundancy.

The ETHERNET telegram contains special switch-over information that is processed in the receiving nodes.



The redundancy concept featuring two independent networks allows both standard components and protocols to be used.

A completely different redundancy concept is created when a control unit is simultaneously connected to two ETHERNET networks. The redundancy mechanism is partly shifted into the user program of the control unit. The great advantage: no special protocols or switches are required. Here, the response time is within the application and therefore within the cycle time of the control program. WAGO's ETHERNET 2.0 750-882 Controller supports this redundancy concept with two independent network ports. Each ETHERNET port has its own MAC address, which is assigned an IP address. Applications requiring a redundant communication structure can be created via two independent networks. The physical structure of the networks is the same, with the networks (A, B) differing only within the address area used. For this purpose, one computer each (PC 1, PC 2) provides control of the network address management via BootP. BootP is a protocol enabling IP address assignment for TCP/IP networks. Both networks should not be directly connected to each other to avoid interference. Each PC establishes a communication link with the 750-882 Controller via each network. One of these four communication links is always an active link with write access. The three other links are passive links, with the PCs only reading the inputs. If a network or PC fails, another link immediately becomes an active control link based on existing links. Switching over is rapid, since no link needs to be established.

Consciously Selecting a Network Topology:

In a redundant network, switching to a backup path is not the only way to determine network time response. The selected network topology (linear, star) also affects data packet transmission in a network. This is evident when considering the time response of the switches required. ETHERNET switches today use a store-and-forward approach —the complete ETHERNET telegram is read by the switch before storing and forwarding it to the correct output port. Delay times result from this procedure and depend on data packet size and forwarding time of the switch. Latency is the time interval starting when the first bit of a packet reaches the input port and ending when the start of the first bit is seen at the output port.

Total latency = (packet size x 8 / baud rate) + forwarding delay (packet size in byte). Table 1. shows the latency and forwarding delay for a switch at 100 Mbit/s and 1 meter cable.

Packet Size	Latency (µS)	Forwarding Delay (µS)
64	7.6	2.5
128	12.7	2.5
256	23.0	2.6
512	43.6	2.7
1024	84.5	2.6
1280	105.0	2.6
1518	124.0	2.6

Table 1. (source: WAGO)

The forwarding delay increases by 1µs when performing the test with a 100m-long cable. Using 10 devices in a linear or ring topology, the delay is 1.3 milliseconds. For 100 devices, it is 13 milliseconds, which is within the PLC cycle time range, but approaches timeout for automation protocols. The star topology requires more cable length than a linear or ring topology. As fewer switches are needed, delay times are greatly reduced. Therefore, the best solution is combining both line and star topology.

Redundant Controllers on the Waterfront

A redundant control network can be efficiently implemented aboard ships if control units have two independent network ports and a redundancy-capable application program is used. Meeting these requirements allows both standard components and protocols to be used for the networks. In the networks, address management is performed by one PC each for both networks. WAGO's 750-882 Controller can serve as a control unit since it supports redundant networks via two independent network ports. Sensor and actuator integration is performed via I/O modules connected to the controller. The controller is programmable to IEC 61131-3 and has 1 Mbyte memory for PLC program codes. It therefore provides PLC functionality and is capable of controlling tasks. The controller uses MODBUS/TCP as the application protocol, but also supports other automation and IT protocols.

WAGO Corporation's 750-882 ETHERNET 2.0 Network Redundancy Controller

The new WAGO ETHERNET MR Controller supports redundant networks via two independent network ports.

Who is Leading Environmental Change?

By Eric Schreiber

In the marine industry, we have key interests in direct conflict with each other. For example, the shipowner wants a solid return on investment for the lifetime of the asset but the shipyard wants to build at lowest cost. Meanwhile, auditors want to be impartial but need to maintain customer satisfaction. Hence, it is sometimes untimely and slow to synchronize a unison change in direction for industry. Once in a while, it does happen. When it does, it is interesting to note who leads it – and how.

HVSC – Cold Iron

More than 10 years ago the first maritime high voltage shore connection (cold iron) was coming on line. Although promoted by local activists, the fervor to put an action plan in place came from shipowners and their engineers. Before any local mandates or regulations were in place, the plan to change the environmental impact came from the owner. While international standards are finally coming in play and legislations are taking effect, the change came over 10 years ago by innovation from the owners and close collaboration with their key suppliers.

Energy Monitoring and Management (EMMA)

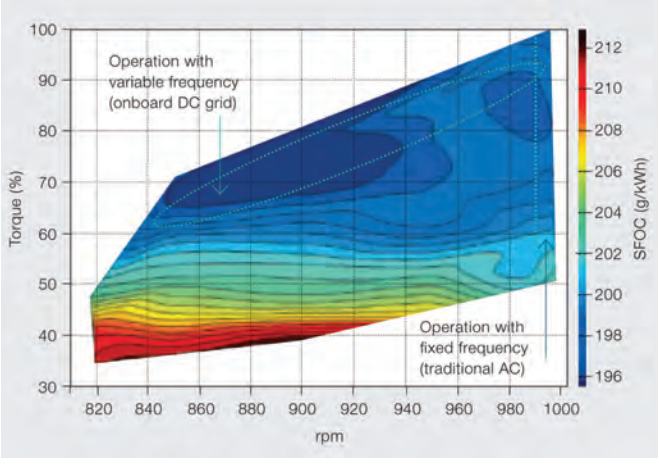
Meanwhile, across entrepreneurial minds and start-up offices plans were coming together on how to improve on reduction of harmful emissions. The cost of fuel was making energy management systems more attractive but emissions abatement is the legislative marketing word of choice. Innovation in most cases came from small workgroups that understood the processes and additionally had the stamina to advocate change. New businesses spring out of opportunity in the market. Ironically, mature industries that already had to innovate to maintain profitability know what methods have the best payback. Cross pollination across these mature and young industries happens primarily in large multinational organizations where individual contributors bring their wisdom to new markets. This was the case with ABB's Energy Monitoring and Management (EMMA) that brought best practices from many industries to the marine market. Some of the entrepreneurial innovators in the marine industry have proven new techniques such as 'dynamic trim optimization' but sustainable innovation development of tools is seldom repetitively from the same person. ABB's solution offers a renewable channel of best practices and innovation as is the case with the optimization tools being delivered through EMMA.

OnBoard DC Grid

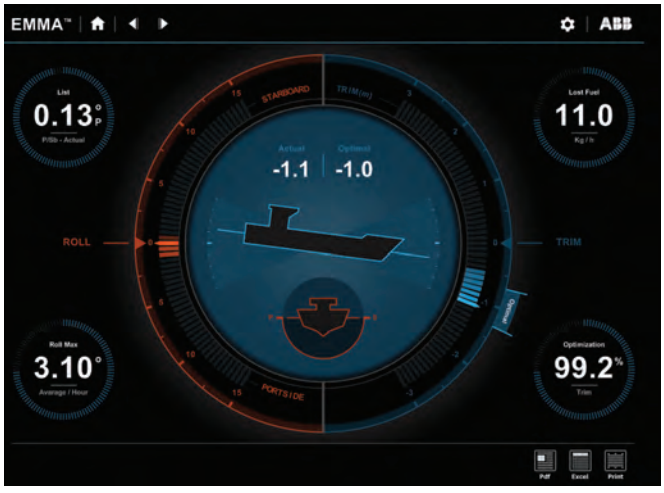
In designing a radical new system, ABB engineers looked at the entire power delivery chain of energy conversions on marine vessels and identified a case for using DC distribution rather than the traditional AC system. Two longstanding and crucial principles have been carried over from the traditional AC distribution system to form the framework of the onboard DC grid philosophy: Personnel and equipment must be protected in case of failures and sound selectivity shall be ensured in such a way that safe operation is maintained after any single failure.

The new system merges the various DC links around the

With the introduction of variable-speed operation of the engine, this window of optimal efficiency can be extended as far down as 50 percent, depending on the engine.



Screenshot of optimal trim controls and readout.



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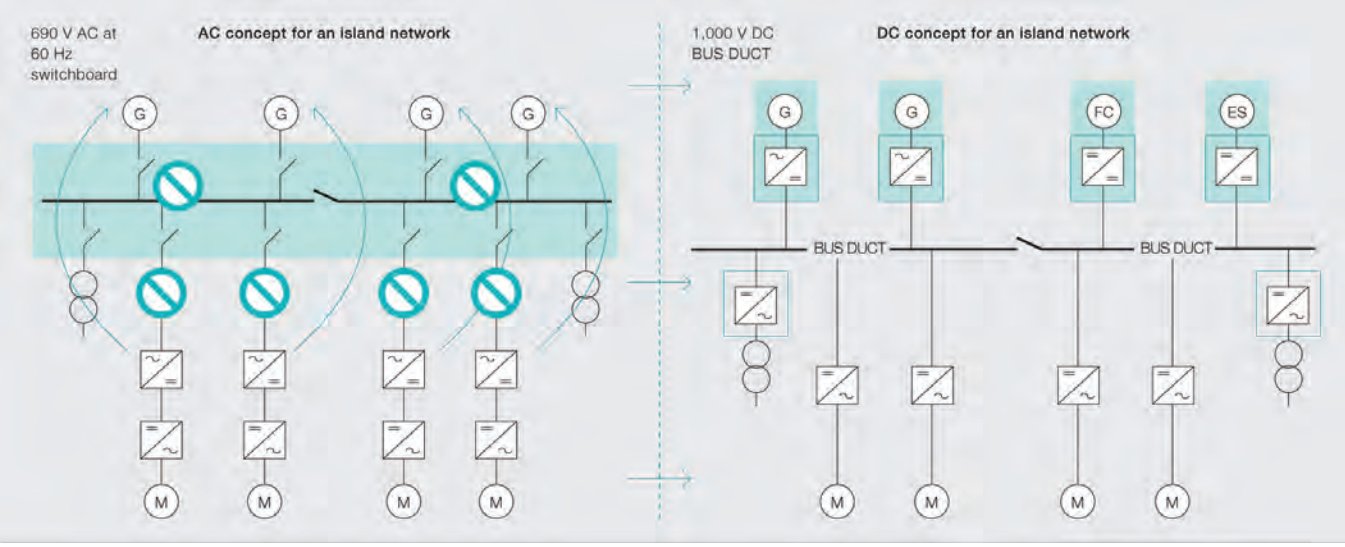

The new system merges the various DC links around the vessel and distributes power through a single 1,000 V DC circuit.

vessel and distributes power through a single 1,000 V DC circuit, thereby eliminating the need for main AC switchboards, distributed rectifiers and converter transformers (Figure 3). All generated electric power is fed either directly or via a rectifier into a common DC bus that distributes the electrical energy to the onboard consumers. Each main consumer is then fed by a separate inverter unit. When an AC distribution network is still needed, for example with a 230 V hotel load, it is fed using island converters, developed by ABB to feed clean power to these more sensitive circuits. Additional converters for energy storage in the form of batteries or super capacitors for leveling out power variations can be added to the DC grid.

The system has been remodeled in such a way that most of the products used in today's electric ships such as AC generators, inverter modules, and AC motors can still be used. The onboard DC grid can be configured in several different ways. With a centralized approach all converter modules are located in one or multiple lineups within the same space that the main AC switchboards used to occupy. With a distributed approach, the various converters can be placed where it suits the vessel operation or design best. The AC generators can have either integrated or stand-alone rectifiers installed in cabinets. As a result, the volume of components that, by regulation, must be installed in the main switchboard room is drastically reduced. This affords the vessel designer a new level of freedom in designing the electrical power system to increase vessel functionality and value.

Best Practices Meet New Thinking

The DC grid concept utilizes AC generators and motors, but allows for increased efficiency because the system is no longer locked to a specific frequency (usually 60 Hz on ships), even though any 60 Hz power source may still be used. The new freedom of controlling each power consumer independently opens up numerous ways of optimizing fuel consumption. When operating marine combustion engines at constant speed, the fuel consumption is lowest at a very small operating window, typically around 85 percent of rated load. With the introduction of variable-speed operation of the engine, this window of optimal efficiency can be extended as far down as 50 percent, depending on the engine (Figure 4). If the engine is operated at loads below this, the engine efficiency remains significantly higher than that of the traditional fixed speed equivalent. The end result is that a typical offshore support vessel can achieve fuel savings of up to 20 percent.

By eliminating bulky converter transformers and main

switchboards previously needed with the traditional AC system, the onboard DC grid also reduces the footprint of the electrical equipment used. This creates more space and provides greater flexibility in the positioning of system components in the vessel. In addition, the system enables simpler integration of supplementary DC energy sources such as solar panels, fuel cells or batteries into the ship's DC electric systems, creating scope for further fuel savings.

In Use Today: End User Dividends

ABB will equip a newbuild platform supply vessel with a full onboard DC grid system, including all power, propulsion and automation systems. The 93 meter multipurpose vessel, designed by the Norwegian company Marin Teknikk, is due for delivery in the first quarter of 2013. The vessel has five variable-speed diesel generators, four rated at 2,240 kW and one at 920 kW, two 2,200 kW main propulsion units and three additional thrusters for DP operation.

The reduced weight and footprint of the installed electrical equipment will vary depending on the ship type and application, but in one case the use of the onboard DC grid system on a platform supply vessel (PSV) reduced the weight of the electric system components by 25 percent from 115 to 86 tons. And, this is just one way in which environmental change is coming to the waterfront – this time, for good.

The Author

Eric Schreiber is Sr. Manager, Business Development at ABB Inc. Prior to that, he was Manager, Engineering Services at Royal Caribbean Cruises, and additionally has served as a surveyor at Lloyds Register.

Ballast Water Treatment

Demystifying the Buying Process

When the Coast Guard's final rule on ballast water management became effective in June, the event perhaps signaled the end of one arduous journey for regulators, but the beginning of another for shipowners. The U.S. rule establishes discharge standards for living organisms which ballast water management systems (BWMS) must be able to satisfy. This so-called phase one standard closely conforms to the IMO's version, bringing the dream of global standardization one step closer. Globally, ballast discharge standards are also inching towards the finish line, as the IMO standard gets closer to ratification with only a few more signatures and a greater percentage of the world's tonnage needed for ratification. Despite delays by various governments, that standard is widely expected to enter into force within the next two years.

By Joseph Keefe, Editor

Good News – Bad News

Notwithstanding the good news, it is also not hard to understand why so few operators have, to date, installed BWMS on their vessels. The depressed state of global shipping markets over the past few years certainly has played a role. Not everyone has the reported average price of $1 million per ship needed to install the systems, and those who do, are reluctant to do so until they absolutely have to. Also lurking just around the corner is the separate, but equally important U.S. Environmental Protection Agency's ongoing Vessel General Permit process, which also covers ballast water discharges. Adding to that uncertainty is the myriad of individual U.S. state mandates still in play and the specter of a stricter, U.S. Coast Guard (phase II) standard.

One thing is certain: a large percentage of the world's merchant fleet will eventually need to be fitted with a BWMS. The question of when, where, how and which system to employ represents one of the more critical business decisions facing operators today. Real concerns remain about the availability of sufficient numbers of suitable ballast water treatment equipment, as well as whether new deadlines can be met. As many as 70,000 vessels – of differing size, purpose, trading pattern and myriad other variables – may need to be fitted with BWT equipment within this decade, with the greatest numbers estimated to likely happen in 2017, 2018 and 2019. Now, there is little time to waste and this is also no time to make a mistake. What you do next will make all the difference.

Let's Go Shopping

What should you look for in a ballast water treatment (BWT) system? Actually, that depends on a number of variables. Asking the right question(s) of your vendor up front could eventually make all the difference as you move towards compliance. What you will probably discover is that there is no "silver bullet" when it comes to BWT systems. The variables to consider are many; and there are many questions to

pose to your potential vendor. ***MarPro*** has listed (some of) the more important considerations below:

The Manufacturer

Arguably, as much attention should be paid to the staying power, financial stability, global reach (partnerships) and viability of a particular vendor as you might give to the quality of their BWT product. Some firms have been in the billion dollar BWT game for more than a decade and some are just coming to the table, as evidenced by the explosion in the numbers of type-approved systems in the last five years alone. That's not to say that a new player can't get the job done. More importantly, though, will your vendor be around in five years? Is BWT just a passing trend for them or is it the sector where they have earned their reputation? Finally, ask yourself (and them): Do they have the infrastructure to service your equipment in a timely manner when something goes wrong?

Research

Third party studies of any technology – the Maritime Environmental Research Center (MERC) at the University of Maryland, for example – are a good source of impartial data. Research flag state and IMO approvals – making sure your prospective system is approved in the regions you are likely to transit could be important. It might also be mandatory. Given the potential size of this market, it should not be a surprise that manufacturers, particularly those just entering the game, might rush development efforts and go to market with equipment that might not have been adequately tested in a wide range of water types and marine environments. And, the California State Lands Commission report states, "… we mention in the reports that classification society requirements play a role and must be taken into account when selecting a BWMS. But most of the class approvals are for safety or mechanical issues and our focus has been on the biological efficacy of the systems. So we mainly report on approvals that deal with efficacy, and also water quality concerns."

Due Diligence / Pilot Program

Standardization drives efficiency. That's a fact. You really don't want to be dealing with multiple brands and types of systems. Get two BWMS of the same type, vet them, and then standardize across the breadth of your homogenous fleet. Use this "pilot program" to then lock in long term contracts and then secure favorable pricing. Those who wait too long won't enjoy the pricing that today's robust competition provides and may not be able procure the numbers of units that they need at times of peak demand. Even if you are not willing to go all in at this point, it is important to dip your toes into the water.

Warranty

What kind warranty does your manufacturer provide? Do they have the viability to back it up? Do they provide a spares kit with installation? Coverage can be negotiable, depending on deal size. It is here where global reach (partnerships) will become very important.

The Maritime Research Center's (MERC) barge-based mobile test platform.

N.E.I.
Treatment Systems

Ballast Water Treatment
Ballast Tank Protection

Proven treatment AND corrosion protection

- VOS does not restrict your trade routes: fresh or salt water, cold or warm water, clean or polluted water-**VOS works every time**
- VOS does not use any restrictive filters or corrosive oxidizers-VOS will not slow your ballast rates or require you to neutralize upon discharge
- VOS will extend the life of your structure and coatings by more than 80%-Very low oxygen equals very low oxidation
- VOS anti-corrosion benefits are tested and proven: N.E.I. fully supports the complete removal of all ballast tank cathodic protection

VOS ensures compliance, with a POSITIVE financial impact

Built for the realities of global trade, VOS is 100% effective,100% of the time. Any water, any port in the world: **WWW.NEI-MARINE.COM**

N.E.I. Stripping Gas Generator: provides a single source of treatment for the entire vessel.

Untreated steel coupon-270 day corrosion test

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VOS Treatment does not require the use of corrosive chemicals…no neutralization necessary for overfill or topside discharge.

Cost of System

There is a very good reason that this bullet was not placed at the top of the list. That's because some owners will look for the "cheapest" system available. The initial purchase cost is only one component of what your new BWT system will entail. After installation, will you experience reoccurring expenses related to supplies, chemicals, maintenance? A poorly operating system or one which requires heightened backend attention may eventually cost you a lot more, especially if it means off-hire time in the yard. Increasingly, vendors are moving towards lower acquisition costs, but these dollars then come back into the equation for items such as filters and UV lights.

Installation

How difficult will it be to install the system, how long will it take and how long will your vessel be out of service?

Availability

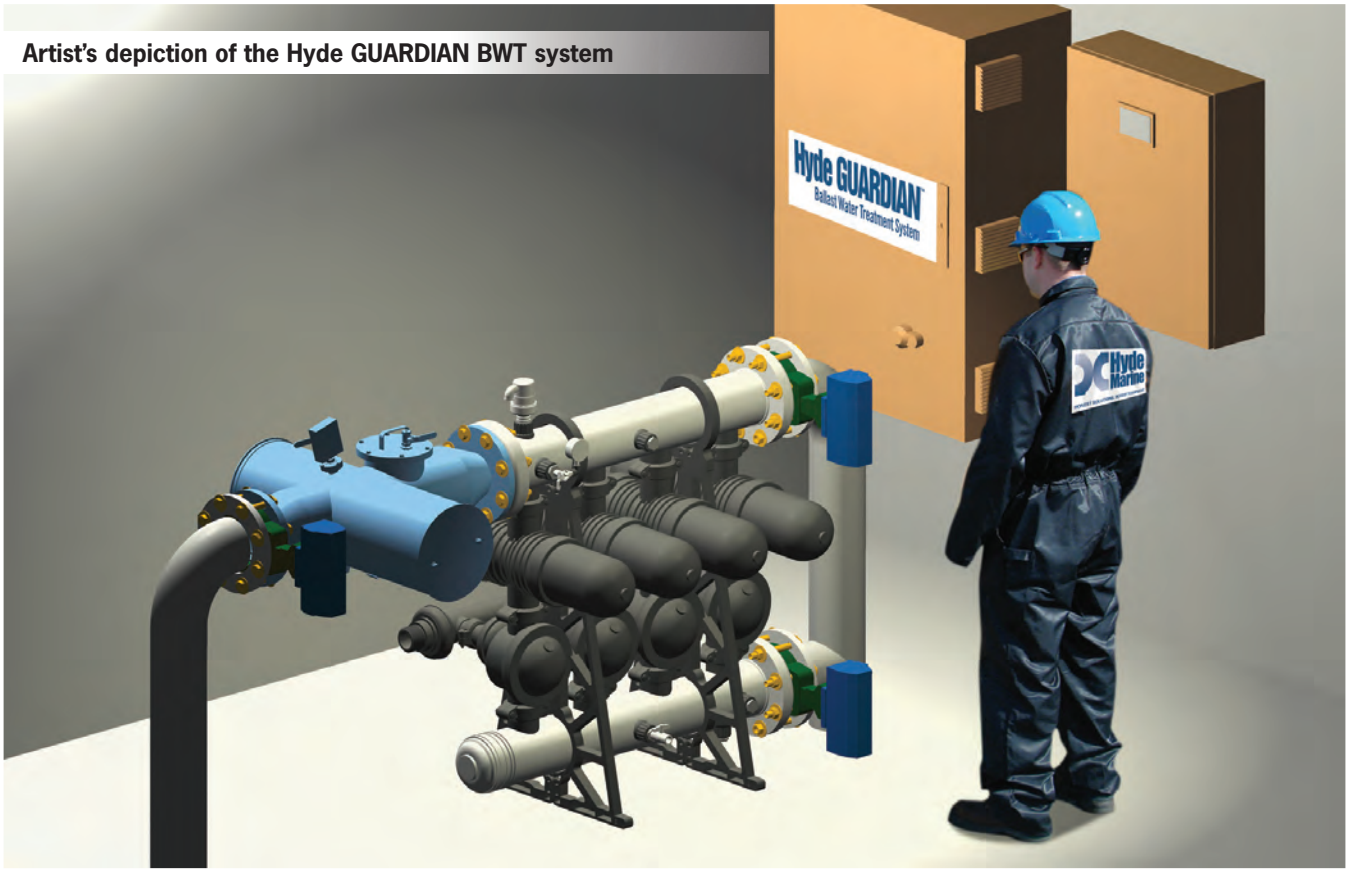
The dozens of "approved" systems on the market create the impression that the equipment is immediately available. That may not be the case. Newer entries into this equipment equation may not have the manufacturing capability (yet) to meet demand from customers. How long will you have to wait for delivery? Are you in the queue with 1,000 other vessel operators and their collective 70,000+ vessels?

Cubic Footprint

Will the system fit onto your ship and if so, will it hinder your operations and ability to perform commercially. Will it reduce your cargo carrying capacity? As the rules get pushed down to the smaller hulls (think: EPA VGP) getting the system onto the 79 foot hull may be harder than you might first think. Hence, that system that can move 5,000 cubic meters per hour on a VLCC might not be the best choice for your 85 foot research vessel. Conversely, some units double in size as they double their throughput capacity. That's not a good thing when space is at a premium.

Maintenance

In many cases, a simpler system may be better than the one that includes everything except the skin diver with a spear. Beyond this, a complicated system may require heightened maintenance costs and if some of that falls onto the shoul-



Artist's depiction of the Hyde GUARDIAN BWT system

ders of your crew, it eventually creates operational headaches. General rule; the fewer moving parts, the better.

Safety

For systems that employ an "active" substance, safety issues need to be considered. Who will be handling the chemicals and where will they be stored? Will the crew need special training for these tasks and how much manpower will be needed to attend to this aspect of your ballast water management? On the other hand, deoxygenization has been billed touted for its ability to inert the ballast tanks. If a ballast tank were ever to be breached and flooded with hydrocarbons, this could be a real consideration.

Coatings, Seals, Gaskets & Valves

Questions are being raised – and being discussed by regulatory bodies, including the IMO – about the long term effect of BWMS on applied coatings in ballast tanks. This may affect your decision especially considering a system employing active substances. On the other hand, some systems, particularly those employing deoxygenization, are suggesting that these systems might allow the elimination of sacrificial anodes from the ballast tanks, saving millions of dollars over the life of the vessel. More testing needs to be done, however, because at present insufficient evidence exists on the full impact of a particular system on a particular coating or the corrosion that may occur. Curiously, and for the purposes of this article, paint and coating manufacturers declined to comment for the record. Beyond the coatings, the collective effect of active substances on valves, seals and gaskets is not particularly well known at this point, either.

Holding Time

Depending on the typical length of your vessel's voyage, some treatments requiring time to work – deoxygenization, for example – might not be appropriate for your operational requirements. On the other hand, if your ships typically operate in foreign trades involving long sea passages, then this may not be an issue.

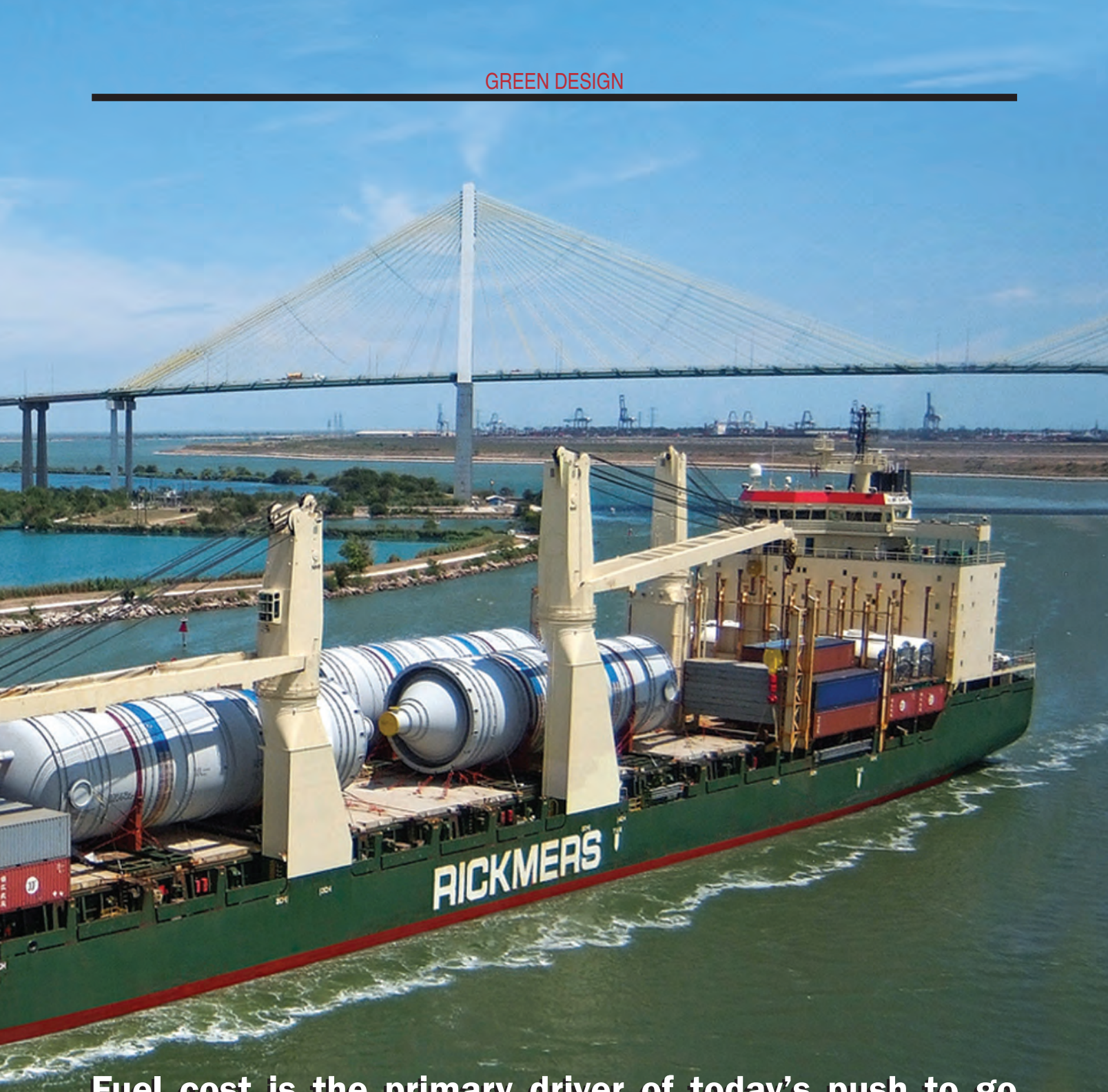
Routing

Will your fleet transit very cold (Arctic), fresh, brackish or salt waters – or, perhaps all four? Some chemicals may not work as well in colder temperatures, and fresh water may require the introduction of brine into the process in the case of electrochlorinization. And those vessels transiting and taking on ballast in particularly muddy and murky waters may not be

(Continued on page 63)

Going Green *for the Green*

Rickmers Singapore is one of five ships in the fleet to be equipped with the EMMA Energy Management system that increases profitability and reduces the carbon footprint, all at the same time. At current fuel prices, the estimated payback of the system is estimated at less than a year.



Fuel cost is the primary driver of today's push to go "green." While the side benefits extend much further, industry nevertheless moves ahead with extreme caution.

By Greg Knowler

Shipping lines trying to stay a step ahead of legislation aimed at reducing carbon emissions are embracing the development of "greener" vessels, but the urgency with which the industry is pursuing fuel-efficient ships is being driven by pure commercial considerations. Fuel accounts for more than two thirds of the operating costs of a vessel. As carriers struggle with weakening demand and sharply falling profitability, the need for innovation in ship design has become more pressing than ever. "We are entering into a renaissance of design," said Luis Benito, Global Strategic Marketing Manager, Marine at Lloyd's Register. "The question is; what is the optimum speed of a container ship right now, and what will it be up until the ship is 15 or 20 years old?" The answer lies in the design, and it has become a search for the elusive area where greater speed and fuel efficiency meet. It is a complex issue and one that is pegged to the price of fuel, which has such a huge impact on the profitability of a shipping line. For the last couple of years, profitability has only been a word spoken in whispers in the corridors of container shipping companies that are struggling to deal with an avalanche of new capacity flooding into service. Market researchers Alphaliner estimate that the global cellular fleet capacity passed 16 million TEUs in June with an additional 620,000 TEU to be delivered in the second half. Most of this capacity is, or will be, deployed on the main East-West trades.

Yet the sovereign debt crisis in Europe has had a devastating effect on Asia-Europe while the transpacific trade slowed as US consumers tightened their belts. Burdened by excess capacity, the resulting fall in freight rates saw the liner industry collectively losing US$8 billion last year.

With the first half of the year out of the way, the predictions for 2012 are not encouraging. Container lines have been slowing vessels for the last three years to cut down on fuel consumption, but lengthening transit times is a practice that gets liner customers steaming. Adding days, and sometimes more than a week, to a voyage costs cargo owners money and disrupts supply chains.

Designing the Fix

What the container shipping business needs is for vessels to sail at the same speeds of three years ago and use less fuel in the process, and it is the quest for this speed-to-consumption operating band that is driving innovation in design. Classification societies are playing an increasingly active role in this process, advising shipyards and shipowners to find the right design that meets efficiency needs and is compliant with energy and environmental requirements.

"We work with yards and owners to understand the design range that we need to have," Benito said. "We cannot just design ships with certain types of specifications. We need to expand the minds of designers – it depends very much on the brain power of the designers and of our people."

Ernst Meyer, regional manager South East Asia for Det Norske Veritas, said there had been a huge improvement in energy efficiency forced by the high fuel price, speeding up the development of innovative solutions. "Fuel is a big cost element for a shipowner so a yard understands it needs to come up with propulsion systems and hull designs that help with fuel efficiency," he said.

"Some designs are developed in Europe and these designs are picked up by Asian yards, under license, but we also see examples where Asian yards are coming up with their own designs and they are improving on the efficiency side." The economics of profitably running a ship have changed with the high cost of fuel and ship designers are trying to raise the economics back up so a vessel can sail at higher speeds while consuming less fuel.

Meyer adds, "Challenging the designers and developing tools where we can look at designs early and analytically to see how they can work within regulations and with yards. But it is more a consulting basis where we use the competence we have in house to develop a better design."

Germanischer Lloyd believes there is growing recognition in the maritime industry that "off the rack," whether in ship design and operation or in the management of a fleet, is no longer the only option for carriers. Being able to tailor individual vessels was essential to continuing profitability.

Steen Brodsgaard Lund, executive vice-president managing director Asia Pacific for Germanischer Lloyd, said measures were being applied to enhance fuel efficiency and reduce emissions and these were considered during the ship design, the operation of the fleet in the upgrading of existing vessels. "The GL Group is engaged with ship owners, operators, designers, shipyards and other industry players to put to good use the data and experience we have gained," he said.

Competition: by Design

The result is a resurgence of design, leading to fierce competition between the older shipyards in Korea and Japan and the new yards in China. Despite the bottom having dropped out of the container market, low newbuilding prices and new fuel-efficient designs are attracting orders. Owners are using the opportunity to contract ships at low prices while also renewing their fleets with more economical ships.

"The industry has woken up and ship owners, yards and designers are working very hard," said Meyer. "The yards are being forced to give guarantees they did not have to in the past. It is becoming very important. It is a different game now, because if you neglect fuel efficiency as an owner or a yard, you can be out of business."

Benito said the yards were grabbing the design challenge and understood that it would only be through higher design power that they would be able to compete. "It is a buyer's market so the ship owners are in the driving seat and they want to get the best optimized design. But there are so many shipyards that need orders and they are using their design capabilities more than before. Our role is to facilitate that relationship and help both parties to develop ships that comply with the rules and that are safe."

LNG-fueled Ships

The drive to find vessels with better fuel economy and lower

The Norwegian Coastguard's LNG-powered Barentshav sails into the Port of Hamburg

emissions has also seen great strides being made in the development of ship engines that run on cheaper, liquefied natural gas (LNG). "If there was enough LNG available in the world, as a ship owner you would have converted your ships immediately because it can easily compete at the current price levels," said Ernst Meyer, regional manager South East Asia for Det Norske Veritas. He adds, "We have developed classification rules for LNG fueled ships so design, build and operating rules are in place for LNG. The big challenge is that LNG is only available in certain ports."

Before the world's container fleet could convert to LNG, the availability of the gas in the world's ports would have to be greatly enhanced. According to Søren Christian Meyer, global sales director for OW Bunker, the physical infrastructure for LNG globally does not exist and governments have so far been unwilling to provide any significant investment in the necessary shore-based infrastructure. Meyer insists, "Access to all large LNG terminals is limited to LNG carriers. LNG bunkering is limited and small ships are unable to berth due to a lack of small ship piers at these terminals or the appropriately sized piping and flanges for supply."

In terms of curbing emissions, LNG beats marine oil hands down. A study into the costs and benefits of using LNG as fuel for container vessels by Germanischer Lloyd and MAN found that using LNG as ship fuel would reduce sulphur oxide (SOx) emissions by 90 to 95 percent.

"The environmental benefits of using LNG as a bunker fuel outweigh the use of low sulphur alternatives and scrubbers, as there are no sulphur emissions with LNG, around 30 percent less carbon and 80-95 percent less nitrogen emissions," the OW Bunker executive said.

"While innovation in vessel design is important, the key challenge for LNG uptake is in the development of the supply chain and a common supply platform, which requires significant investment. It is important to remember that market analysis of LNG pricing is based on the commodity price of LNG, and does not factor in the supply chain costs, let alone the costs associated with recouping the outlay required to build the physical infrastructure in the first place."

Also requiring significant investment is the LNG fueled ships themselves. The cost of constructing an LNG powered ship is estimated at US$180 million for small coastal bulk carriers and oil tankers, and $200 million-plus for larger ships. However, there are pricing issues and supply chain costs that raise questions of long-term viability of converting fleets to LNG. "It could save owners a lot of money if the prices differential remains the same as it is today, but that is a big question mark," said Luis Benito, Global Strategic Marketing Manager, Marine at Lloyd's Register.

Moving Forward: With Caution

Christian Meyer also recommended a cautious and studied approach. "The decision to move towards LNG supply requires close consideration and a sound financial assessment of the opportunities and threats, which will likely take a few years of careful analysis. Particularly in this current market, the risk of committing to LNG supply on a large scale is not a viable option for most bunker suppliers." Yet many flag states are developing LNG-fueled vessels, and in the Baltic Sea, as much as 40 percent of ships will be running on LNG by 2020.

"About five or six ports are looking at LNG bunkering on the Asia-Europe route," Benito said. "Gas will end up covering the core shipping fleet." The industry is vigorously preparing for the inevitable regulation on ship emissions, and various initiatives and working groups are looking at how to reduce carbon emissions while improving shipping's green credentials.

Christian Meyer adds, "It will take time and happen in steps, with the renewal of the fleet being phased in. We have 20 ships in the LNG class, typically running on a commuting basis, for example a ferry or offshore supply vessel. It is gathering momentum and every year there will be many ships added to the global fleet."

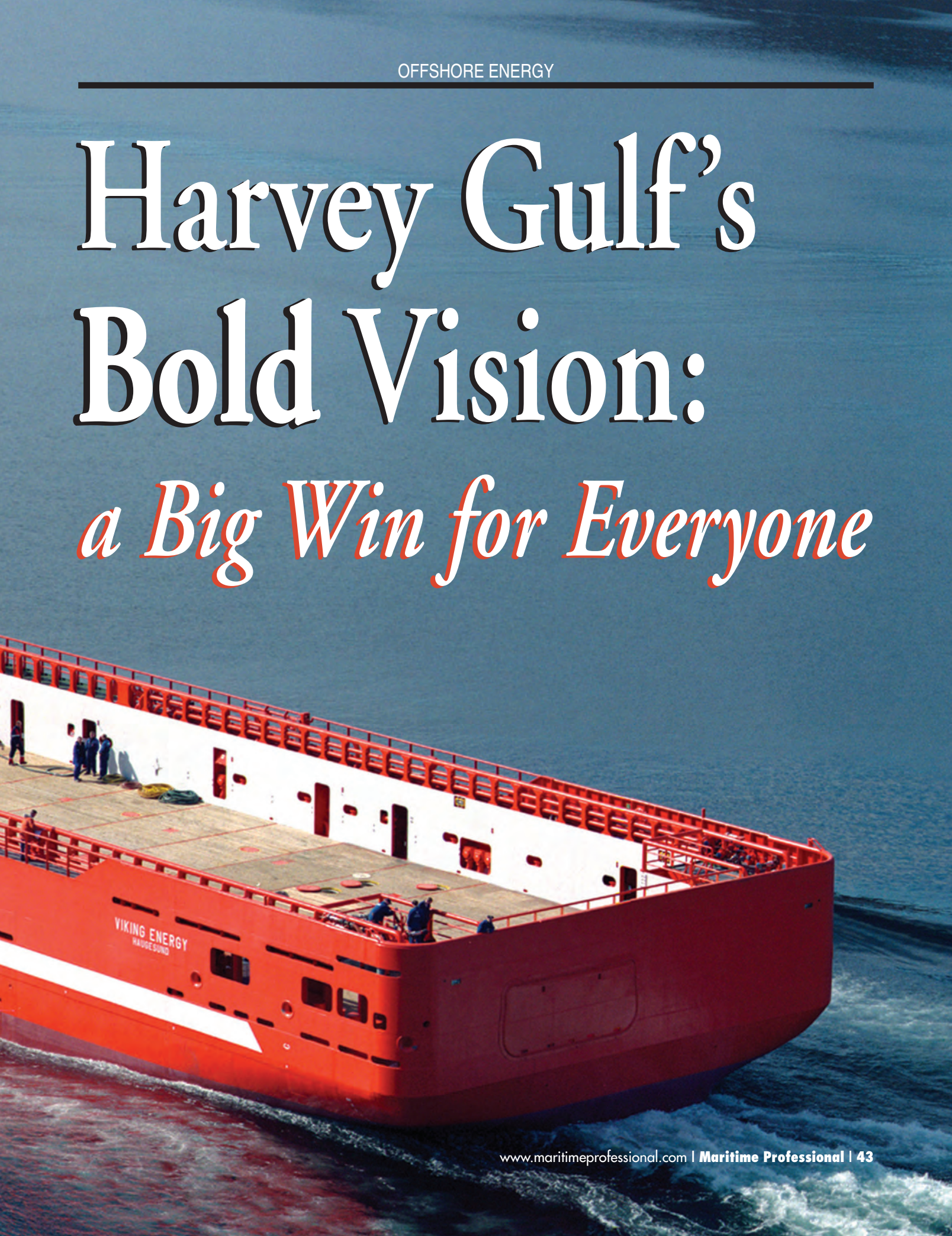
But as important as it is to cut down the polluting impact of vessels, in this era of high oil prices the commercial viability of a shipping line depends on its ability to trim the fuel bill. Sustainability applies as much to the balance sheet as it does to the environment.

Shane Guidry and Harvey Gulf team up with leading industry naval architects, engine suppliers, classification societies, regulatory bodies and a host of others to bring U.S. Gulf of Mexico offshore energy into the 21st Century – and beyond.

By Joseph Keefe, Editor

Harvey Gulf's Bold Vision:

a Big Win for Everyone



Often out in front of the competition in many ways, Harvey Gulf International's effort to build a new class of dual fueled LNG-powered offshore supply vessels (OSV's) again raises the bar higher for those competing in the U.S. Gulf of Mexico offshore markets. Among the first to be classed under the ABS Guide for Propulsion and Auxiliary Systems for Gas Fueled Ships (May 2011), the vessels will be the first dual fueled LNG-powered vessels under US flag. The new vessels will also receive environmentally-friendly notations from ABS. With construction already underway at Mississippi-based TY Offshore, Harvey Gulf International has four of the DP-2 rated (302' x 64') Dual Fuel Supply Vessels on order, with options for two more. The expected delivery date for the first hull could come as soon as mid-November 2013, with the others following in close order (every 3.5 months) after that. What comes next may be the beginning of a remarkable transformation in how business is done in the competitive U.S. GOM trades.

Deep Experience: Rooted in Safety First

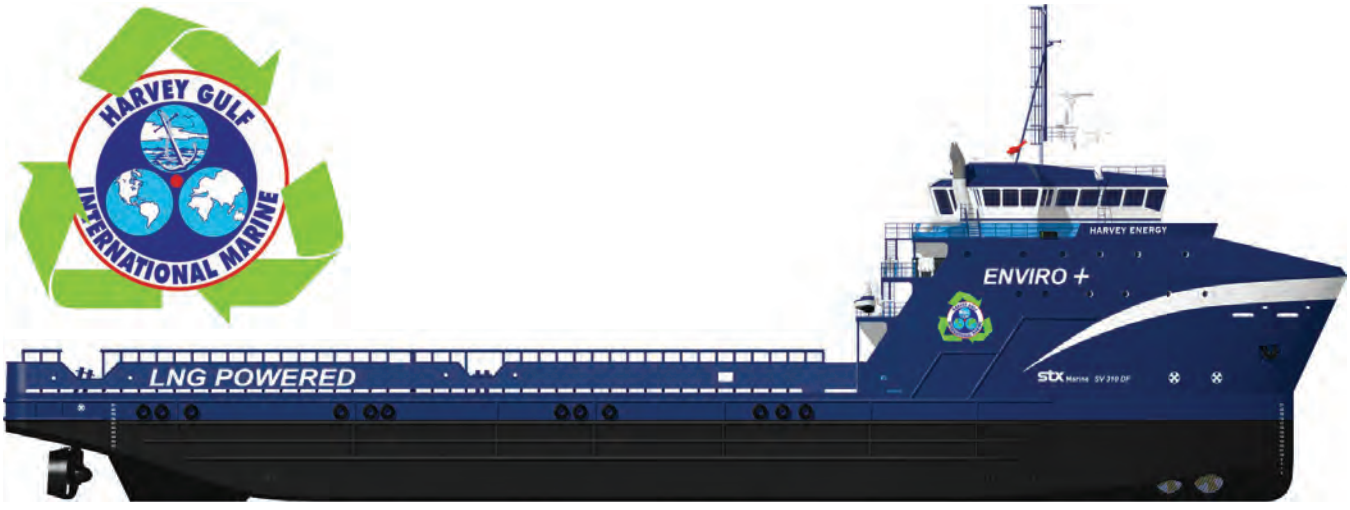
In 2000, Wärtsilä was in on the ground floor of LNG propulsion in Norway. Working with the local directorate there (Coast Guard equivalent), they were initially turned down, but having defined the risks and then working with DNV, the first vessel with natural gas was built – the Viking Energy. Back then, there was no precedent and classification rules had to be written from scratch. Today, and with class rules well developed, the only variable rested in the fact that the U.S. Coast Guard hadn't done it before. But, according to the Coast Guard itself, until regulations can put into place, they would be guided by IMO Resolution (MSC.1 285-86), Interim Guidelines on Safety for Natural Gas –Fueled Engine Installations in Ships.

Pete Jacobs, General Manager for Wärtsilä North America recalls the early days of the project. "They (Harvey Gulf) called us and we developed the overall solution together. The LNG systems and engine technology have not changed significantly from what we have operating in Europe." This dated back to Wärtsilä's early visionary, Trgve Eiken of the Wärtsilä Design Ship Group, and the Viking Energy, which entered into service back in 2003. He added, "So, yes, it is new to the Gulf of Mexico but not new to Europe. That vessel has not lost one hour of downtime due to the LNG equipment since it has been commissioned."

Mike Carroll, Vice President of STX US Marine told ***MarPro*** in July, "The short story is that there is technology out there that Harvey Gulf was looking to offer its clients, giving them options, better rates and better opportunities. So, we worked very close with all parties putting together this concept. This involved ABS and the Coast Guard. We looked at all the manufacturers that were offering dual fuel systems and ultimately settled on Wärtsilä. Once we had the first concept together, we met with ABS to put together a plan to get this in front of the Coast Guard."

From the outset, safety was the key. Jim Gaughan, Vice President & Chief Engineer, Chief Engineer's Office ABS, said, "One of the things that has made this project so successful was that we could work very closely with a small group of people with the Coast Guard who had been participating at IMO in the development of the Interim Guidelines, and were in the process of developing a position for US flag LNG powered vessels. One of the Coast Guard's biggest concerns has been safe bunkering."

Often, however, a stellar safety record in one particular area – in this case LNG transportation – cannot in itself assure similar success when applied to a different, albeit related application. Gaughan continued, "So, STX, ABS, Harvey Gulf and the Coast Guard, have taken what some would call a conservative approach to this design, establishing the safety level that other supply vessel designs will be expected to meet. For example, Harvey Gulf could've proposed locating the fuel tank under the accommodations which would require justification via a safety analysis, but they did not. Similarly, they could've proposed the use of single wall fuel gas piping in the engine



> "Five to ten years from now, we won't be having conversations about the availability of LNG. It will not be an issue. Availability will be there, especially given the variety of projects going on, across different vessel types. The level of interest and activity would certainly suggest that the distribution system in the United States will be in place."
>
> Jim Gaughan, Director of Technology and Business Development on Marine side of ABS

room instead of double wall piping – but they chose not to.

As the project moved forward, it was clear that it would be unlike anything that had come before it. Gaughan neatly summed up the process, adding, "Since this was the first LNG powered vessel built for operation in the US, Harvey Gulf wanted to have the design and engineering completed up front. This has been a case of having all the major parties sitting together at the table during multiple meetings to resolve technical issues as a team."

Cutting Edge Design

Many variables for these vessels had to be considered, including the extra weight involved, more space required for the bunker arrangements, special handling requirements for LNG and the positioning of the bunker tanks themselves. To that end, STX introduced its (patent pending) design which Carroll characterizes as "the functional arrangement of a dual fuel OSV." He added, "The engine meets the latest IMO EPA requirements, but the most important thing is the integration of the LNG system and deciding how that system is most efficiently arranged within the ship. It is not an overly com-

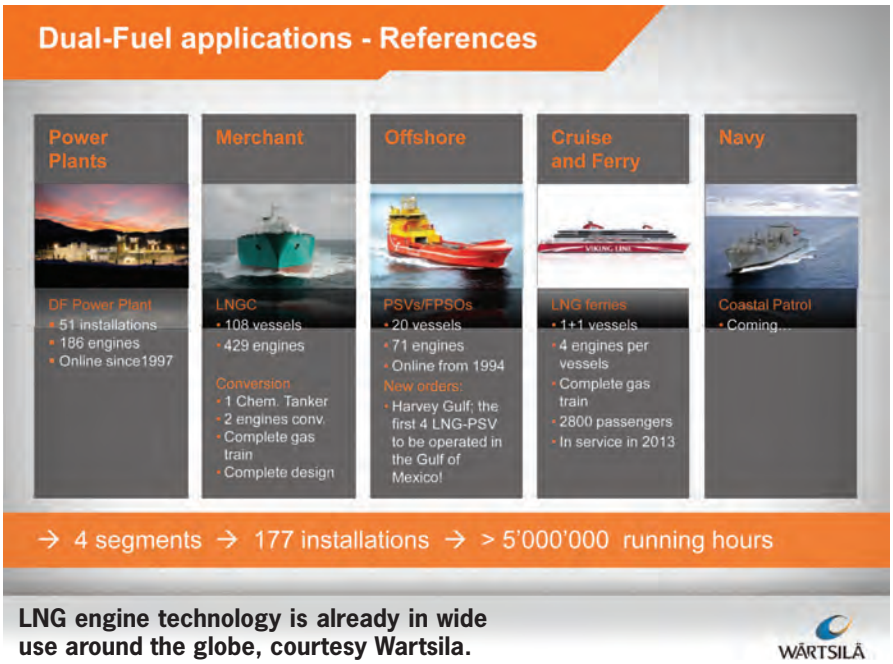
Wärtsilä was awarded a contract to deliver integrated propulsion systems for LNG offshore support vessels (OSV) to Harvey Gulf International Marine. The integrated system includes dual-fuel machinery, electrical and automation package, complete propulsion, and also the LNG fuel storage and gas conditioning system.

> "When operators have pulled cylinders for major overhauls, the engines have been found very clean with almost no wear causing carbon buildup. Harvey Gulf will have a condition-based maintenance program. At major overhaul periods the components will be inspected to determine the effect of the vessel's operating profile on the engine condition. We can then safely determine if the next overhaul interval can be increased, likely saving Harvey Gulf significant time and money."
>
> Pete Jacobs, General Manager
> for Wärtsilä North America

plicated system and from a regulatory framework, the IMO Interim Guidelines was available at the start of the project. We put together a design basis with input from Wärtsilä and ABS, anticipating how to approach the Coast Guard. This gave the Coast Guard the design framework that we intended to follow and allowed them to confirm, deny or modify what we needed to do to make the project work. The recent USCG policy letter on gas fueled vessels is a result of the design basis submitted for this project."

As the boats are built, Wärtsilä is on site in the shipyard in an advisory role. And because the engine itself has no real quirks, it is just like installing a diesel. Wärtsilä's Jacobs said "The only real difference is the fuel piping that's double-walled, but with the engine itself, there's no difference for the shipyard. The learning curve is going to be a short one." But, the process is a new one for U.S. shipyards, and it is likely that the shipyard involved in the first hulls – in this case, TY Offshore – could have the upper hand in future contract bids.

The bunker system, LNG tanks, piping, the electric drive system and the drives themselves, the motors themselves – are all mapped out by Wärtsilä for the design package. Jacobs adds, "In this case, we're providing a complete package including the integrated automation, power management and power distribution systems. For the shipyard and owner, risk is minimized when working with one vender who is responsible for engineering, delivering, commissioning and servicing these critical systems."



LNG engine technology is already in wide use around the globe, courtesy Wartsila.

Problems that Never Were

Whereas many U.S. owners can find any number of reasons to not go ahead with this kind of project, Harvey Gulf's Shane Guidry found every reason to proceed. And, problems anticipated by others turned out to be, for the most part, non-factors. Chad Verret, Senior Vice-President, Alaska & Deepwater Operations for Harvey Gulf explained why.

Chad Verret, Senior Vice-President, Alaska & Deepwater Operations for Harvey Gulf explained why. "As a charterer, the customer typically provides fuel. So, we've got a tender out there that says, for example, a major oil company will provide their own LNG. We've been approached by a few customers that we've pitched these vessels to and their concern is, 'Where are we going to get LNG?' We've told them that if necessary we can secure a reliable source of LNG and facilitate bunkering operations for them. This means that we'll make sure the fuel is available. AS

it stands today, I can pick up the telephone, and be assured that a truckload of LNG can be in Port Fourchon in 48 hours. In my opinion, there is a reliable source of LNG available today."

Pete Gaughan paints a similar picture. "Five to ten years from now, we won't be having conversations about the availability of LNG. It will not be an issue. Availability will be there, especially given the variety of projects going on, across different vessel types. The level of interest and activity would certainly suggest that the distribution system in the United States will be in place."

In terms of supply and safety, Harvey Gulf made no decisions in a vacuum. Instead, Verret visited Norway and Finland earlier this year and met with the operator of four LNG powered PSV's (with a fifth under construction). Verret told ***MarPro*** in July, "They have a number of sites set up for LNG refueling; shore supported facilities and truck supported operations. In place for ten years, these operators have not had one LNG-fuel related incident and no hours of down time related to the engine's gas systems, during bunkering or underway."

A typical supply boat not only carries diesel fuel, but also diesel fuel as cargo. So, volumetrically, there are usually tremendous amounts of diesel on a PSV. With regard to the LNG vessels, the LNG tank itself is a 290m3 tank which volumetrically holds +/- 68,000 gallons of LNG, giving the vessel about 10 days of transit speeds at 12 KT. The engines use 1 percent diesel fuel as pilot fuel. Verret adds, "Because it is dual fuel, if we have an operational scenario that's beyond that, we can also transit in diesel mode and then switch to gas mode once we get on station."

LNG Advantages: The List is Endless

Harvey Gulf CEO Shane Guidry sees considerable upside to this leap of faith. He'll need to, because the cost of these vessels is about 16 percent higher than conventional OSV's. But, the payback promises to be remarkably swift. Wärtsilä's John Hatley explains, "Based on business case studies that we have done, the more energy the vessel consumes, the faster the benefits accrue with the lower cost LNG. For OSV's, that payback of the additional costs can be in the vicinity of just 2-3 years. This is not uncommon. This is also quite dependent on the price estimates for future distillates costs. Obviously, the greater the difference in price between LNG and distillates, the faster the payback can come. And, of course the busier the vessel – the service cycles will come into play. But this isn't just a matter of dollars; it's also about the future emissions regulations. This includes ECA's, and sulfur requirements being pushed out of the fuel. All of these variables will come into the decision process."

For now, the fuel source is significantly cheaper. Verret adds, "We've got quotes for a truck-based refueling operation at less than $2.00 per diesel gallon equivalent. Diesel is about $3.00 plus per gallon today. This is significant when you are talking about a boat that burns 3,000 – 5,000 gallons of fuel per day."

> "The short story is that there is technology out there that Harvey Gulf was looking to offer its clients, giving them options, better rates and better opportunities. So, we worked very close with all parties putting together this concept. This involved ABS and the Coast Guard. We looked at all the manufacturers that were offering dual fuel systems and ultimately settled on Wärtsilä. Once we had the first concept together, we met with ABS to put together a plan to get this in front of the Coast Guard."
>
> Mike Carroll, Vice President of STX US Marine

stx Canada/US Marine

Other dividends abound: running in gas mode significantly reduces the wear on engines. A vessel operated largely in gas mode will extend the life of the engine. Wärtsilä's Jacobs has been involved in the project since the beginning. As the first manufacturer of dual fuel engines for commercial marine markets, no one arguably has more experience with this technology. Jacobs insists, "When operators have pulled cylinders for major overhauls, the engines have been found very clean with almost no wear causing carbon buildup. Harvey Gulf will have a condition-based maintenance program. At major overhaul periods the components will be inspected to determine the effect of the vessel's operating profile on the engine condition. We can then safely determine if the next overhaul interval can be increased, likely saving Harvey Gulf significant time and money. In addition, the vessel will be connected to a remote monitoring and fault avoidance service. Data from the vessel will be logged, trended and analyzed by Wartsila." Jacobs adds, "Our computers crunch those reports on a daily basis. Red flags will be scrutinized by experts to determine if maintenance or a call to the vessel is necessary. Breakdowns can be predicted and avoided based on the trends observed. Spare parts and service can be ordered for the potential problem to be fixed proactively at a convenient and cost saving time." The data feeds will be done via satellite, likely via live data stream.

Balancing the Green

In terms of environmental performance, the decision to go ahead with the dual fuel option was an easy one. That's not to say that there weren't trade-offs. Verret explains, "In gas mode, the engine currently exceeds the IMO Tier III level for category III engines by about 85%. We're confident that we can meet increased levels in the future. Originally, we tried to go with a smaller, lighter engine to fit our application, but we decided to go to the category III engine."

Because the weight of the engines and gensets were three times as heavy as other conventional equipment, the 'tween deck heights had to be adjusted by as much as much as 4 feet. Verret says that although they lost a little deadweight capacity (about 105 tons) in the process, these OSV's have fairly high deadweight ability in general. He admits, "We lost a little, but we did make these vessels ten feet longer. So, the net difference is an increase over our current "Tiger Shark" designed vessels delivering from Eastern Shipbuilding in Panama City, Florida."

Gathering Momentum

In the smooth wake of Harvey Gulf's bold move to dual fuel technology, a torrent of activity for a wide range of marine applications has been seen. In July, Tokyo-based Mitsubishi Heavy Industries, Ltd. (MHI) announced plans to begin developing low-speed, dual-fuel, marine diesel engines capable of using not only conventional heavy oil but also natural gas for their fuel. In August, Washington-based Totem Ocean Express (TOTE) announced an $80 million conversion from diesel to LNG for two 840-foot containerships. TOTE insists that the conversions will pay off well prior to retiring the vessels. Faced with coming rules stipulating low-sulfur distillates that promised a 25 percent fuel price hike, the move makes a lot of sense. And then, there's Netherlands-based Veka-Group's announcement that it had developed three new LNG tankers, which can also be used as bunker ships. One, an LNG inland

waterway bunker ship, is the first of its type. Propelled almost completely on 'boil off,' it is billed as an "emission-free" vessel.

Separately, ABS in the Americas alone has about twenty projects where people are watching Harvey Gulf. Pete Gaughan adds, "We're talking to ferry boat operators, supply vessel operators and people involved in Jones Act trades. Clearly, these projects will be easier to develop where the vessel is always coming back to the same port for bunkering. So, supply vessels and ferries will likely be first out of the gate. In other places, it won't be so much about economical concerns, it'll be a scenario of 'go clean or you can't operate.' The Great Lakes is one of those places. But no one is going to change to LNG on a vessel with only five years of service left in the hull. Regarding the capital costs, all parties agree: it's more expensive to install engines capable of burning natural gas than conventional engines. So the payback has to be in fuel savings and compliance with stricter environmental regulations which are coming."

Globally, the marine experience for dual fuel engines exceeds 500 engines employed on more than 125 vessels. In terms of marine experience alone, more than 4 million largely trouble-free hours have been logged. Still, the Harvey Gulf project might be perceived by some as something new and risky. In reality, it is anything but.

Only One Obstacle, but Unlimited Upside

When it comes to the Harvey Gulf project, all of the players could agree on one thing: Shane Guidry the lynchpin of the deal. Pete Jacobs told ***MarPro*** in July, "Finding an owner who was aggressive enough to move forward was the key. Shane Guidry is that man. He made a brilliant business decision. We go to conferences and speak to owners who always have hesitation, thinking of any number of reasons why it can't be done. Guidry took the step to just do it and within a very short period of time, he had many potential sources of gas identified. He put himself in the driver's seat."

Guidry's vision extends to places most in the U.S. markets wouldn't bother to go. Taking lessons from what the Norwegians are already doing, the Harvey Gulf vessels will also be fitted with state-of-the-art accommodations. According to Mike Carroll from STX, "These will be on par with any four star hotel you could go into. The Gulf of Mexico and North Sea markets grew up separately. Over the years, they've gotten closer. So, the vision goes beyond the GOM itself. Shane Guidry wants to be able to position his boats anywhere in the world and be on par with the competition – foreign or otherwise. They've incorporated the best of both into these hulls."

Harvey Gulf is carefully plotting a course for others to eventually follow in their wake. But, with all we know today, you have to wonder what the others are waiting for.

Veka-Group's LNG inland waterway bunker ship is the first of its type in the world. The tanker sails almost completely on the 'boil off' of the load and is 100% emission-free.

Maritime Trends: 2020 & Beyond

By Greg Trauthwein, Editorial Director

If hindsight is 20/20, then one might assume that predicting future market trends to the year 2020 is a severely myopic endeavor. As most in the maritime industry can attest, the clarity of future regulations is often only crystallized by the most recent disaster and resultant rules. But Norwegian classification society Det Norske Veritas (DNV), not one to shy from a challenge or bold prediction, has embarked on an intensive study dubbed "Shipping 2020" which it contends will help to deliver clarity to shipowners regarding future emission-reduction and energy-saving technologies for the world fleet.

While accurately predicting future events may evoke memory of Carnac the Magnificent, DNV embarked upon and earlier this summer presented findings from its study "Shipping 2020," a study undertaken as the class society increasingly found itself being asked (and in turn asking itself): "How can we predict the deployment of important emission-reduction and energy-saving technologies in the world fleet by 2020?"

Although accurate predictions on how commercial vessels will be outfitted, powered and fueled eight to 10 years down the road seems fuzzy at best, helping to bring clarity to the situation is the undeniable convergence of trends – trends in technology, its maturity and adaptation; trends in environmental regulations; and trends in world economy and fuel consumption.

"We have looked at the world economy and the demand for transport; we have looked at the environmental regulation; we have looked at technology trends; and we have looked at fuel choices, fuel alternatives and fuel prices," said Tor E. Svensen, President, DNV, when presenting Shipping 2020's findings in Athens on the occasion of Posidonia 2012. Svensen freely admits that the subject is far from conclusive, with a number of factors in the coming years ultimately shaping the reality.

"There are many, many variables in this. It's about the market, it's about the technology; the technology maturity, and the cost benefit. But there are also clear indications that technology, as it's adopted by more and more, becomes more cost effective."

Key Findings from DNV's Shipping 2020 Report

1. 30% of Newbuildings will be delivered with gas engines in 2020;
2. Demand for Marine Distillates will be around 200 to 250 million tons;
3. New ships in 2020 will emit 30% less CO2; with EEDI as the main driver;
4. LNG is the cost-effective fuel choice for ships sailing more than 30% of their time in ECAs;
5. Scrubbers will not be a significant option before 2020.

The Technology

Technology plays a central role in making the marine industry more efficient, cost-effective and in compliance with rapidly evolving environmental rules. While shipowners are widely hailed as "conservative" in their approach to new technology adoption, it is a clear trend that the future industry leaders will be those that identify and adopt the best technologies

"The challenge is of course making the wrong investment decision (in the wrong technology) will be detrimental both to the industry as a whole, and to individual company," said Svensen. "And wrong decisions will impact the finances of the company quite strongly."

LNG as fuel is one of the emerging technologies that most clearly has been identified and moved forward as a potential solution in many respects, financial and environmental topping the list. In predicting that 30% of the new buildings delivered by 2020 will be gas engines, DNV takes the assumption that energy costs overall will continue to rise, and that LNG prices will remain 30% lower than that of heavy fuel oil (HFO). In this scenario, DNV's report estimates 1,000 newbuildings delivered with gas engines (either LNG or dual fuel) over the coming nine years, a number equaling 10-15% of the expected newbuildings.

While there are a number of factors playing into this prediction, DNV sees the global sulfur limit assumed to be effective from 2020 as having the most significant impact on the implementation of gas engines, provided of course the capacity and fuel supply are there.

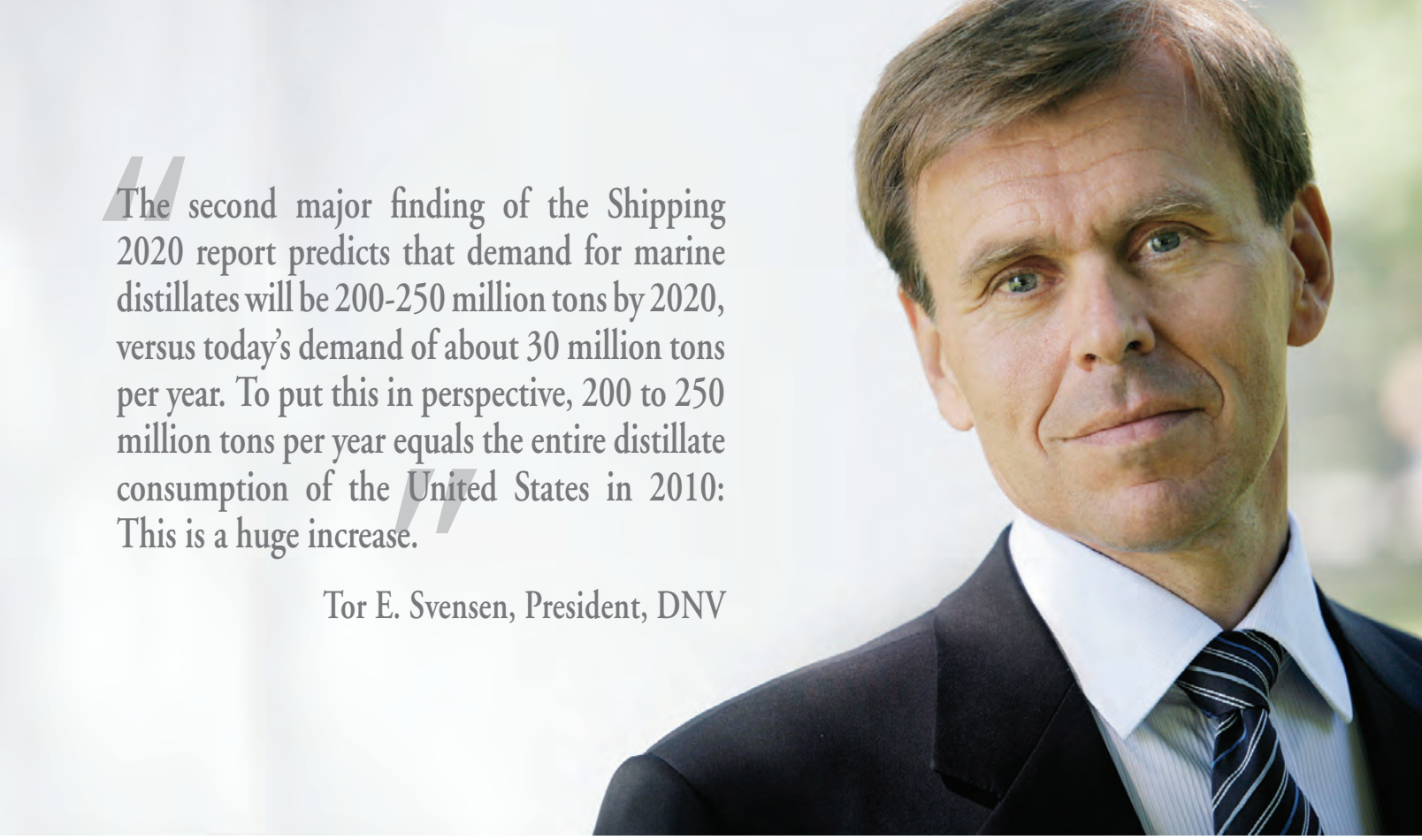
Scrubbers are another area of marine technology that were factored into the Shipping 2020 study, though DNV – based on the very low price of LNG as compared to HFO – sees a limited demand for scrubbers until 2020, estimating a modest 200 installations per year.

"We do not see scrubbers as a significant option between 2020; we believe that distillate fuels will win this game," said Svensen.

However, the picture changes in 2020 with the implementation of stricter sulfur content rules, but to reiterate, many of the findings in the study are closely tied to the predicted (yet often unpredictable) price of energy, and how they stack up comparatively. After 2020, when the new limits enter force and ships are tasked to run on low sulfur fuel or clean exhaust always, the potential for scrubber technology perks up greatly, with the possibility of installation on several thousands of ships.

Fuel to Burn

It goes without saying that the future of heavy fuel in the



> "The second major finding of the Shipping 2020 report predicts that demand for marine distillates will be 200-250 million tons by 2020, versus today's demand of about 30 million tons per year. To put this in perspective, 200 to 250 million tons per year equals the entire distillate consumption of the United States in 2010: This is a huge increase."
>
> Tor E. Svensen, President, DNV

marine environment is fading fast, as the DNV Shipping 2020 study estimates that HFO consumption will plummet from about 290 million tons in 2019 to only 80 to 110 million tons in 2020.

Simultaneously, the availability of cleaner alternative fuels comes with some questions. A leading impediment to the adoption of LNG as fuel has been the dearth of bunkering stations to fulfill demand – a classic 'chicken or the egg first' scenario which requires substantial buy in to spark the construction of LNG fueling portals; while the scarcity of LNG-fuelled vessels has slowed investment in expanded fueling points. Exceptions to the rule are smaller vessels on regular routes – ferries, OSVs, and shuttle tankers, for example – where the bunkering scenario is much more concise and predictable.

New market regulations may help to expedite the market for LNG fuel, as the Shipping 2020 study contends that in the big ship market, LNG will become a cost-efficient option for ships that spend more than 30% of their time sailing in ECAs. Specifically, when the 0.1% sulfur limit in North America and Northern Europe comes into force in 2015, about 40% of the world fleet will be affected, with the larger, oceangoing ships being somewhat affected, while the smaller tankers and general cargo carriers that may spend all of their time in ECAs being hit the hardest.

The adoption of marine distillate fuel is another matter, as DNV – in the second major finding of the Shipping 2020 report – predicts that demand for marine distillates will be 200-250 million tons by 2020, versus today's demand of about 30 million tons per year. To put this in perspective, "200 to 250 million tons per year equals the entire distillate consumption of the United States in 2010," said Svensen. "This is a huge increase." The adoption of and restrictions associated with Emission Control Areas (ECAs) will help to effectively bump up the adoption of marine distillate fuels, but the Shipping 2020 reports finds that the big increase will be in 2020 with the introduction of new stringent global sulfur limits.

Methodology

By its own admission, DNV clearly states in its overview and repeatedly so at its presentation in Athens that the results of the study are subjective to a wide range of factors that independently and in unison could dramatically change the reality by 2020.

As an overview, the creation of Shipping 2020 was not done in a vacuum in the halls of Høvik, Norway, rather the creators considered real-world ships and operating circumstance. In all, six major factors, including: Megatrends and External Drivers; Future scenarios; the World Fleet; Technology Options; a stochastic simulation model developed by DNV using the ExtendSim software; and finally, a reality check, interpretation and analysis to arrive at its conclusions.

Agree or disagree the conclusions of Shipping 2020, but the efforts by DNV and other organizations that seek to studiously examine and help shape the major maritime issues of the day should be encouraged and lauded, as it is impossible to get a clear view if you're not even looking.

E

Energy

Navigating Energy Management Decisions

By Hector Sewell

Energy management means helping the industry understand, and navigate, a way through, the challenges of designing novel concepts and the adoption of new technologies. The shipping industry faces two big challenges right now that will most effectively be met by energy management and an understanding of new technology and how to use it. The two big challenges are the rising costs of energy in increased bunker bills and compliance with environmental regulation.

To some extent these challenges are, as has often been said, two different sides of the same coin. If carbon pricing or market based mechanisms directed at shipping were to be adopted they would be directly linked: fossil fuel bunker consumption, such as burning HFO as used by nearly all shipowners today, not only leaves shipowners exposed to the market price of bunkers but also to any future carbon 'price' for using those bunkers. Conversely, in such a situation, reductions in fossil fuel consumption relative to other players in the market could provide a 'win-win' effect – reduced bunker bills and reduced exposure to carbon taxation or market mechanisms.

Energy Management in Practice

As we know, the industry is looking at alternative sources of bunker fuel, efficiency saving technologies, auxiliary propulsion options and operational measures to cut fuel consumption and address regulatory requirements. This is why there is so much excitement about LNG – the combination of no sulphur and low to zero NOx emissions as well as speculation about relatively low pricing based on dramatic expansion in assessments of exploitable gas reserves has got a lot of people pondering ... 'is gas the future fuel for shipping?'

Where does this leave shipping today? The answer is the need to be acutely aware of operational performance and how it can be improved. We call this energy management. Shipowners will benefit from bringing a high degree of focus on their efforts to understand and manage their energy use. Some shipowners are doing this already. But few have a total approach to energy management. What's some good advice for shipowners looking to get to grips with energy management?

A good first step is to consider adopting the ISO 50001 energy management standard. This is probably the first standard available to shipping that could actively improve owners' bottom line. The overall principle of the standard is to help companies identify, at a strategic level, how to reduce energy costs – in new designs, in existing ships and in all operations. With

this approach adopted, complying with requirements such as SEEMP becomes much easier. Overall, making decisions becomes more straightforward – although not necessarily easy.

Asking the Right Questions

A question such as, 'Should I use LNG as a fuel in my ships?' becomes easier to address using an energy management approach. Most of the questions that need to be answered are along the lines of, 'What risks do we face?' Understanding risk is fundamental to then being able to make decisions. And we can see this as new technology emerges.

The industry needs new designs, it needs new technologies and it needs optimal methods to understand and implement them. Today nearly all new ships are built based on classification rules. But how do we approve and accept novel concepts where there are no rules? To some extent this question takes us right back to where classification began – when there were no rules.

Rules for the construction of ships emerged from an understanding of risk acquired through operational experience: the test was the voyage; a ship left for India and when (or if) it returned the experience and its performance on the voyage was shared, the materials and structure were examined and anecdotal evidence was shared. Today we can and need to assess risks in different ways but based on similar principles by applying a simple but effective methodology of identifying risk and verifying how those risks could be addressed.

Today, understanding future fuels, future engines and future designs is everything – for both newbuild and retro-fit. Shipowners need help making decisions. Providing the right decision making support through the design process is critical. Many technologies, many fuels, many designs can be made safe – but at what price? At the end of the day it all comes down to the bottom line. By understanding and verifying technical risk issues the owners and operators of the world will be in a better position to make critical commercial decisions. The methodology described below throws some light on the issues by looking at the topical issue of the location of LNG-as-fuel tanks.

Methodology: Novel concepts and designs

In order to guide the industry in making decisions about novel concepts and new designs Lloyd's Register has created a specific risk methodology. The methodology consists of single, scalable risk assessment process based on four stages:

- *concept study,*
- *scoping the assessment itself,*
- *detailed synthesis of design solutions, and*
- *final assessment.*

The methodology is structured so that the scoping phase generates an agenda that sets which risk studies to perform: the extent of the resulting scope is dependent on the degree of

Hector Sewell, LR Global Marine Business Development Manager

novelty of the proposed design. The assessment (typically an initial set of HAZID-type studies) identifies significant issues prior to engaging in designing. The synthesis involves a guided choice in the type and depth of detailed assessments needed to justify the equivalent level of safety and reliability asked for in our rules. The final assessment includes operational risk studies (e.g. typically HAZOP-type) on the proposed final design, so that all hazards associated with the operation and maintenance of the gas-fuelled system are identified and dealt with.

This methodology guides designers, builders, owners and technology developers in creating concepts that would be classed as being safe and reliable while meeting industry operational and other requirements. Knowing just how far to go both pre and post contract is crucial to the process. But, get it right pre-contract, involve the right stakeholders and document the process properly and all investors receive a welcome boost of confidence.

An example of where this is being used is in the approval of LNG-as-fuel gas tank location based on risk studies that demonstrate that the gas-fuelled machinery system includes adequate risk mitigation - so that the level of safety and reliability is equivalent to that associated with conventional oil-fuelled propulsion and auxiliary machinery. Lloyd's Register has been, and is involved in, a number of projects where gas tank location is a significant issue. Most LNG-as-fuel applications either delivered or completed to date have been in small ferries but LR has been involved in some significant projects breaking new ground, namely the Viking Grace – at 56,000 gt the largest LNG-as-fuel application by far and the motor tanker Argonon, the inland waterway tanker and first newbuilding LNG-as-fuel tanker project to be delivered.

All of this brings us back to managing our two big challenges: the rising costs of energy in increased bunker bills and compliance with environmental regulation. Both solutions can co-exist in the same hull. We call this energy management.

ENERGY MANAGEMENT

Chicken and Egg

LNG bunkering logistics dampen owner's LNG power enthusiasm.

When sail gave way to steam, the British Royal Navy dominated global maritime trade routes. It had the power and outreach to build a global chain of coaling stations for its warships. The availability of steam coal at strategic points gave commercial shipowners the confidence to order coal-powered steamships and the transition from sail to steam was very quick. Unfortunately for backers of LNG power for ships, there is no Navy today with the sort of scope and reach enjoyed by the British in their heyday. Doubts over LNG bunker availability are holding back what many claim should be a quick switch from diesel to gas power for large chunks of the global merchant fleet.

Environmental Benefits vs. Logistics

"The benefits in terms of improved environmental performance and lower costs of LNG power are well known now," says Andrea Cogliolo, head of innovation at Italy's RINA Group. "The technology is well proven too, and there are over thirty ships with LNG power in operation. Class and yards and engine builders are ready to go with gas-fueled designs. Gas prices are likely to fall further, as massive new gas discoveries combine with shale gas to increase global gas supply. The gas price in the US has fallen sharply already to levels which look very attractive for powering ships. But we are not yet seeing a dash for gas, because owners cannot yet answer the one simple question – Where can I bunker my vessel?"

If you are Norwegian the answer is simple, LNG bunkers is available at fixed points and by road truck in Norway. This explains why the 33 ships with LNG power today are all operating around the Norwegian coast. A further 20 or so LNG-powered ships are on order, but they are mostly ferries for short, fixed routes where LNG bunkers can be built in as part of the investment in the route. There are reports of an LNG-powered bulk carrier being ordered in China, but most owners need to see a solid global LNG bunker chain before they can invest in LNG power.

"There are two aspects to the LNG bunkering question," says Cogliolo. "One is how you do it; the other is where you do it. Unlike oil, which is relatively simple to store, transport and handle, these two questions have a number of complex answers when we begin to examine how to develop an LNG bunker chain."

Regulatory Uncertainty: Port Safety

Before LNG bunkering can even address technical and logistic questions, it has to overcome regulatory uncertainty. "We have the rules in place for gas-fueled ships," says Cogliolo. "But we can't make rules for ports. LNG as fuel is not

covered by national or international regulations and only IMO non-binding guidelines are available. The IMO IGF Code is still under development and is unlikely to be in place before 2014. Class can fill the gap until then for ships, but there are many doubts over local rules in ports and local authorities. There may be traffic limitations on LNG-fueled ships in some ports and possible prohibition of simultaneous commercial operations during refueling."

As ports move to install LNG bunker facilities, they also should consider the need for LNG tanks with loading arms or a system whereby LNG is to be provided by LNG bunker barges or by LNG tank trucks. "Permits for this infrastructure by national and local authorities are generally based on the production of a safety case and this is a lengthy process," explains Cogliolo. "This can be based on the proven experience to date, especially in Norway, and the guidelines in the draft IMO IGF Code, SIGTTO STS Transfer Guide and ISO 28460 (2011) for LNG ship-shore interface and port operations. Some LNG complications not needed with oil bunker stations could include safety distances and exclusion zones for workers and public in port areas, the possible need of quick release mooring hooks on terminals and problems with LNG venting which could be prohibited on environmental grounds. Couplings must minimize the LNG release upon connection and disconnection."

There are different solutions to the LNG supply problem, which could involve tank truck or containers of LNG which are physically loaded onto the ship and exchanged when emp-

ty, tank trucks to supply the ship via hose, terminal or storage depot hose to ship or ship to ship transfer. There are already examples of each of these systems in operation, and any future LNG bunker chain will involve a mix of the methods. "In Norway so far most bunkering of LNG is by tank truck or from smaller LNG storage terminals, usually with flexible cryogenic hoses but also in some places with LNG loading arms. My expectation is that we will see a lot more small LNG bunker tankers doing ship-to-ship transfer as investment in LNG-fueled ships begins to look more attractive," says Cogliolo. He adds, "Some of these small LNG tankers have already been built and are in operation. They can deliver the volumes needed quickly and they get round many local storage and local port issues by operating outside the port."

Global Issues: Local Solutions

While RINA is a global classification society, its backyard is the Mediterranean. There, it is active in helping Italy to develop as an LNG importing and distribution hub for Europe. "We want to use our expertise with the world's first offshore LNG terminals to help develop an LNG bunker chain in the Mediterranean area," says Cogliolo. "If we can help Mediterranean fixed route shipping like ferries to switch to LNG that will go a long way to improving air quality in this area. If we can give deep sea owners confidence that they can bunker LNG during a Mediterranean voyage or transit then we will also have helped the 'chicken and egg' situation which is holding back the switch to LNG fuel."

RINA is also coordinating the COSTA project (CO2 & Ship Transport emissions Abatement by LNG) which is partly funded by the EU and which is tasked with identifying the obstacles to LNG adoption in the Mediterranean and near Atlantic and drawing up an LNG master plan for implementation of an LNG bunker chain. The COSTA project links governments, port authorities and industrial players around the Mediterranean including Italian shipowners Grimaldi and Grandi Navi Veloci and the maritime administrations of Italy, Greece, Spain and Portugal.

"The European Commission may not have the power the Royal Navy once had," says Cogliolo. "But they are doing all they can to facilitate LNG bunkering development, in the Mediterranean and also in the Baltic area. The COSTA project will learn from the Baltic and Norwegian experience and also look at the feasibility of Europe's Atlantic islands including the Madeira and the Azores becoming transatlantic LNG bunkering stations. The project will be completed by 2014, just before ECA limits in both Europe and the US coastal areas cut permissible sulphur emissions to 0.1 per cent. The high cost of clean residual fuel and the lower cost of gas will be a big incentive to move forward. We have a large chain of LNG terminals already in the Mediterranean. Our next move has to be to find common standards which all these terminals can adopt and so move forward to build the bunker chain shipping needs to make this transition to cleaner and cheaper fuel."

The Antony Veder-owned Coral Methane is one of the first small LNG vessels capable of delivering LNG bunkers

FLEET PERFORMANCE

Trim Optimization:

Increasing Propulsion Energy Efficiency for a Wide Range of Hulls

By Captain Melvin Mathews

In a challenging market, commercial shipping operators must be particularly astute in the way they run their fleets. Trim optimization has been revealed to be a powerful means of increasing propulsion energy efficiency, but does this apply to all vessel types and what level of savings is possible? An unprecedented new study by Eniram (www.eniram.fi), Finnish provider of energy management solutions for the shipping industry, has some answers. Melvin Mathews, former VLCC Captain and now Director of Regulatory and Environmental Solutions at Eniram, considers the implications for fleet owners.

Efficiency through Adaptability

For maritime vessels to move at maximum efficiency through the water they must be able to adapt readily to conditions around them. Speed at all costs is not prudent, so crews must be able to respond to their environments and fine-tune performance so that a carrier is working with and not against weather and sea conditions – and in such a way that this is harmonized with passage and docking schedules. Weather, wind direction, tides and port requirements all have a bearing on the way a vessel's performance will need to be managed.

The more competitive the market and the higher the fuel prices, the more shipping companies must look for innovative ways to manage operating costs efficiently and effectively. There are substantial environmental pressures now too, giving fleet owners additional reasons to review fuel efficiency.

However all of this relies on having a clear line of sight across a vessel's performance at any given time, and the ability to see how this compares against optimal performance. The ability to compare current efficiency against known best practice is essential in showing crews the adjustments that need to be made to get closer to the ideal. Technology in the shape of a dynamic trimming solution is increasingly being adopted to help the crew gain that insight.

The Impact of Trimming

In the cruise industry, trimming is known to have solid benefits in enabling more efficient management of propulsion-based energy (typical savings potential having been found to be around 2 to 5 percent). In the commercial sector, including VLCCs, however, the impact of optimized trimming has been more of a gray area – until now.

To establish the broader potential of trim optimization across commercial vessels, particularly VLCCs, Eniram set out to investigate in detail the impact of dynamic trimming on propulsion power consumption on of a 320,000+ DWT

> "The study indicates that VLCCs benefit significantly from trim optimization, primarily due to their size and rate of daily fuel consumption. The results demonstrated a trim savings potential of 2.6% during the study period. The savings potential is calculated based on the existing operations of the vessel. This maximum possible benefit translates to $482,000 or 730 tons of fuel savings annually."
>
> Melvin Mathews, former VLCC Captain and now Director of Regulatory and Environmental Solutions at Eniram

> To establish the broader potential of trim optimization across commercial vessels, particularly VLCCs, Eniram set out to investigate in detail the impact of dynamic trimming on propulsion power consumption on of a 320,000+ DWT tanker.

tanker. Eniram started with an assumption that there would be limited scope for real performance improvements on a large commercial vessel of this type through trim optimization, due to their relative 'box' shape and the large variation in their drafts according to whether they are in laden, partly laden or ballast condition.

Previously, the complexity of large tanker operations has created access issues on VLCCs for the purpose of site surveys, technical attendance, and installing measurement equipment. Offshore operations can cause additional hurdles around immigration and custom clearance. A comparative limitation in satellite broadband capabilities on some tankers in comparison to other types of vessels adds to the challenges of getting the necessary data from the vessel to our data processing center without delays.

Eniram patiently overcame these issues and, using its proprietary technology, embarked on extensive monitoring of all internal and external conditions affecting the given vessel over a 450-day study period during its lengthy voyage across the world's oceans. To ensure the research was robust, Eniram integrated its technology with engine automation and bridge systems. Attitude sensors were also installed, to collect information on dynamic movements of the vessel including trim, list, accelerations and decelerations.

Isolating the different influencers of performance

Eniram was able to analyze the amount of energy consumed by different factors (trim, sea state, wind, squat, hull and propeller fouling, etc). Modeling all the dynamic factors for various

speeds and power outputs of the vessel, at various drafts or displacements, enables a precise determination of the optimum dynamic trim in real time. Thereafter, based on Eniram's Dynamic Sea Margin methodology, it was possible to compute with precision the vessel's savings potential and present extremely accurate verification of the achieved savings as a result of trim optimization.

The study indicates that VLCCs benefit significantly from trim optimization, primarily due to their size and rate of daily fuel consumption. The results demonstrated a trim savings potential of 2.6% during the study period. The savings potential is calculated based on the existing operations of the vessel. This maximum possible benefit translates to $482,000 or 730 tons of fuel savings annually.

How much of this trim potential is realized depends only partly on how much time the vessel spends at the optimum trim. Crew diligence in implementing system advice and prevailing weather conditions are at play here. The quantity of extra fuel consumed due to non-optimal trim also depends on how far away the vessel is operating from the optimal trim. In this study, the results showed an average positive rate of usage (ROU) of 69%, translating into actual propulsion energy savings of 1.8% - $330,000 or 505 tons of fuel annually - for the VLCC studied.

The complete savings potential is not practically achievable in the case of large vessels, due to operational constraints such as draft restrictions at arrival and departure ports, transit through shallow straits or during ballast water exchanges. However, on voyages where such restrictions do not exist, the ROU can be very close to 100%. Indeed another surprising and almost counterintuitive finding of the study is that the potential fuel savings through dynamic trim optimization is higher on a laden voyage than in ballast.

Due diligent trim optimization and monitoring of hull fouling resistance can mean potential annual fuel savings for tankers.

Maximizing the Rate of Usage

In a typical scenario, it can be assumed that 85% of the total power reaching the propeller converts to speed, 15% being lost to the present sea state, wind, fouling and other dynamic factors the ship has little or no control over. The granularity with which Eniram is able to monitor each of these factors individually is unprecedented. By harnessing readings from a comprehensive range of signals across a vessel, and charting performance across a broad range of differing conditions, we are able to distill information about the extent to which factors such as trim, sea state, wind and other dynamic factors – is affecting a vessel's efficiency.

This detailed, differentiated data has a wide range of applications as it allows comparison between identical voyages or direct comparison between sister vessels (the test vessel operating in the Pacific Ocean can be easily compared with another built to the same specification encountering widely differing weather and sea conditions in the Atlantic Ocean).

Having achieved this independent measure, Eniram is in a unique position to act as an impartial verifier between a ship operator and savings solution providers, accurately measuring the real savings being achieved by 'weeding out' the relative impact of dynamic factors that are beyond anyone's control.

Findings concerning the impact of added resistance due to hull fouling were also noteworthy. While cruise operators can usually predict the rate of increase in fouling because their routes are very predictable, tankers don't have this luxury as they don't have their schedules planned with the same precision, and cover greater distances across oceans. As a result, it has been challenging, until now, for tanker operators to quantify the impact of fouling on fuel consumption.

Eniram's granular analysis of propulsion usage on the target VLCC was able to isolate the added impact of resistance. It revealed that fuel consumption due to fouling grew by nearly 3% over the study period. The average impact on propulsion power consumption was 1.5%, translating to $277,000 (420 tons of fuel) annually. The ability to quantify the impact on fuel consumption is an important contribution on the road to understanding vessel performance and hull maintenance needs based on measured hull performance parameters.

Real-time Reactions

As the Eniram study has shown, tanker operators like cruise-ship owners can benefit financially and environmentally from operational intelligence if available – allowing them to achieve tangible reductions in fuel consumption, and associated costs and CO2 emissions. Today's fragile market conditions and highly regulated environmental demands make this especially important for the commercial shipping sector. That commercial fleets potentially have as much to gain as cruise operators is welcome news for an industry under immense financial and competitive pressure.

These gains must be worked for however, and this requires ongoing assessment of current performance in the given conditions compared with the known potential of the vessel concerned. Continuous fine-tuning of trim, speed and hull conditions based on real-time performance visibility and just-in-time decision-making is the key to maximum savings. For operators previously foundering, the ability to take dynamic action based on real-time performance data and known benchmarks, is an exciting proposition.

The full VLCC Propulsion Energy Efficiency Study report can be downloaded from http://www.eniram.fi/VLCC-tanker-study-order.

The Author

Melvin Mathews is a former VLCC Master and now Director of Regulatory and Environmental Solutions at Eniram, Finnish provider of energy management solutions for the shipping industry.

Ballast Water Treatment Systems ...

The issue of Ballast Water Treatment and invasive species could well be your biggest headache today. That's because it is an unusually confusing issue. In July, the California State Land Commission (CSLC) staff reviewed information for 63 Ballast Water Treatment Systems (BWTS). In the last five years, the number of treatment systems has nearly doubled (28 to 63). Over the same time period, systems receiving Type Approval according to IMO Guidelines jumped from just 1 in 2007 to 22 in 2012. Over 75% (48) of the treatment systems utilize a combination of methods, most of which combine mechanical treatment with other method(s). Aside from mechanical separation, the most common method in BWTS is chemical and 41 use an active substance in the treatment process; 18 systems use electrolysis which may generate an array of oxidants including bromine, chlorine, and/or hydroxyl radicals; 6 use electrochemical generation of sodium hypochlorite; 6 use ozone; 2 use Peraclean Ocean; 2 use chlorine (not electrically generated); 1 system uses chlorine dioxide; 1 system uses ferrate and 5 systems use other chemicals including a coagulant or biocides. Any single treatment method might not be sufficient to treat ballast water to required standards, but in combination, they produce the desired result. The exhaustive, complete list is shown here:

Ballast Water Treatment Systems (Source: Reviewed by CSLC Commission Staff / July 2012)

Manufacturer / Country	System Name	Technology Description	Approvals
21st Century Shipbuilding / Korea	ARA Ballast	F + plasma + UV	IMO B & F
Alfa Laval / Sweden	PureBallast 2.0/2.0 Ex	F + O (UV + TiO2)	IMO B & F (Norway)
AQUA Eng. Co. Ltd. / Korea	AquaStar BWMS	F + E + N (sodium thiosulfate)	IMO B & F
Aquaworx ATC GmbH / Germany	AquaTriComb	filtration + ultrasound + UV	IMO Basic
ATLAS-DANMARK / Denmark	ABWS	F + E (ANOLYTE + CATHOLYTE)	
Auramarine Ltd. / Finland	CrystalBallast	F + UV	
Brillyant Marine, LLC / US	BrillyantSea	electric pulse	
Coldharbour Marine Ltd. / UK	Coldharbour BWTS	D	
COSCO / China	Blue Ocean Shield	hydrocyclone + F + UV	IMO B (China)
(DMU-EEI) / China	DMU OH BWMS	F + active oxygen radicals & ions + N (sodium thiosulfate)	IMO Basic
DESMI Ocean Guard / Denmark	DESMI Ocean Guard BWTS	filtration + ozone + UV	IMO Basic
Ecochlor / USA	Ecochlor BWTS	F + B (chlorine dioxide)	IMO B & F, STEP1, (Germany)
EcologiQ / US Canada	BallaClean	deoxygenation	
Electrichlor / USA	Model EL 1-3 B	electrolytic generation of sodium hypochlorite	
Environmental Technologies / US	BWDTS	ozone + sonic energy	
Envirotech / Singapore	BlueSeas BWMS	F + E + N (sodium thiosulfate)	IMO Basic
ERMA FIRST ESK Eng. / Greece	ERMA FIRST BWTS	F + hydrocyclone + E + N (sodium bisulfite)	IMO Basic and Final
Ferrate Treatment Tech. / US	Ferrator	B (ferrate)	
GEA Westfalia / Germany	BallastMaster BWMS	F + E + N (sodium thiosulphate)	IMO Basic

... Many Solutions – Even More Choices

Manufacturer / Country	System Name	Technology Description	Approvals
Hamworthy / Netherlands	AQUARIUS -EC BWMS	F + E + N (sodium bisulfite)	
Hamworthy / Netherlands	AQUARIUS UV	filtration + UV	
Hanovia / UK		F + UV	
Hanla IMS Co., Ltd. / Korea	EcoGuardian	F + EC + N (sodium thiosulfate)	IMO Basic
Hi Tech Marine / Australia	SeaSafe-3	heat treatment	New S Wales EPA
Hitachi / Japan	ClearBallast	Coagulation + magnetic + F + S	IMO B & F (Japan)
Hyde Marine / USA	Hyde Guardian	F + UV	STEP (UK)
Hyundai Heavy Industries / Korea	EcoBallast	F + UV	IMO Basic and Final
Hyundai Heavy Industries / Korea	HiBallast	F + E + N (sodium thiosulfate)	IMO Basic and Final
JFE Engineering Corp. / Japan	JFE BallastAce	F + B (sodium hypochlorite) + C + N (sodium sulfite)	IMO B & F (Japan)
Katayama Chemical Inc. / Japan	SKY-SYSTEM	B (Peraclean Ocean) + N (sodium sulfite)	IMO Basic
KT Marine Co., Ltd. / Korea	KTM-BWMS	C + E + N (sodium thiosulfate)	
Kuraray Co. Ltd. / Japan	MICROFADE BWMS	F + B (calcium hypochlorite) + N (sodium sulfite)	IMO B & F
Kwang San Co. Ltd. / Korea	En-Ballast	F + E + N (sodium thiosulfate)	IMO Basic
MAHLE Industriefiltration / Germany	Ocean Protection System	F + UV	(Germany)
MARENCO Tech. Gr. / US	MARENCO BWTS	filtration + UV	
Maritime Solutions Inc. / US	MSI BWTS	filtration + UV	
Mexel Industries / France	Mexel	non-oxidizing biocide	
MH Systems / USA	MH BWT System	D (inert gas + CO2)	
Mitsui E & S / Japan	SPO-SYSTEM	F + mechanical treatment + B (Peraclean Ocean)	IMO B (Peraclean MEPC 54)
Mitsui E& S / Japan	FineBallast MF	pre-F + microfiltration (membrane)	
Mitsui E & S / Japan	FineBallast OZ	F + mechanical + ozone + N	IMO B & F (Japan)
NEI / USA	Venturi Oxygen Stripping	D + C	Liberia, Malta, Marshall Islands, Panama, STEP
NK-03 / Korea	BlueBallast	ozone	IMO B & F (Korea)
Ntorreiro / Spain	Ballastmar	F + EC + N (sodium metabisulphite)	
Nutech 03 In.c / USA	Mark III	ozone	

Manufacturer / Country	System Name	Technology Description	Approvals
OceanSaver / Norway	Mark II	F + E	IMO B & F (Norway)
OptiMarin / Norway	OptiMarin Ballast System	F + UV	(Norway)
Panasia Co. Ltd / Korea	GloEn-Patrol	F + UV	IMO B & F (Korea)
Pinnacle Ozone Solutions / USA	Aquatic Enhancement Sys	F + ozone + UV	
Qingdao Headway Tech. / China	OceanGuard BWMS	F + E + U	IMO B & F (China)
RWO Marine Water Tech. / Germany	CleanBallast	F + E + N (sodium thiosulfate)	IMO B & F (Germany)
Samsung Heavy Industries / Korea	Purimar BWMS	F + E + N (sodium thiosulfate)	IMO B & F (Korea)
Samsung Heavy Industries / Korea	Neo-Purimar BWMS	F + E + N (sodium thiosulfate)	IMO B & F
Sea Knight / USA	INSITU BWMS	D + biological augmentation	
Severn Trent De Nora / USA	BALPURE	F + EC + N (sodium isulfate)	IMO B & F, STEP, (Ger.)
Siemens / Germany	SiCure	F + EC	IMO Basic and Final
STX Metal Co. Ltd. / Korea	Smart Ballast	E + N (sodium thiosulfate)	IMO Basic
Sumitomo Electric Ind. / Japan	SEI-Ballast System	filtration + UV	
Sunrui Marine Env. Eng. / China	BalClor BWMS	F + EC + N (sodium thiosulfate)	IMO B & F (China)
Techcross Co. Ltd. / Korea	Electro-Cleen System	E + N (sodium thiosulfate)	IMO B & F (Korea)
Techwin Eco Co. / Korea	Purimar BWMS	F + E + N (sodium thiosulfate)	IMO Basic & Final
Wärtsilä Corporation / Finland	Wartsila BWTS	F + UV	
Wuxi Brightsky Electronic / China	BSKY BWMS	F + UV	IMO B & F (China)

(**KEY**) **F:** Filtration / **C:** Cavitation / **E:** Electrolysis / **P:** Plasma / **N:** neutralization **O:** oxidation / **S:** Separation / **U:** Ultrasound / **EC:** Electrochlorination / **D:** Deoxygenization / **IMO B:** Basic / **IMO F:** Final

STEP: a USCG experimental use approval that applies to the combination of one vessel and one treatment system. STEP enrollment includes a rigorous technical and environmental screening, but is not a type approval process.

All systems using active substances require IMO Basic & Final Approval. These systems must also comply with all applicable requirements of the EPA VG and CA Section 401 Certification of the VGP. According to CSLC, classification society requirements play a role and must be taken into account when selecting a BWMS. But, they say, most of the class approvals are for safety or mechanical issues and the CSLC focus has been on biological efficacy of the systems only. ***It's not easy being green.*** **Which one should you use?** That depends on literally 1,000 variables. You'll need to make up your mind soon. Turn to page 33 of this edition for help.

(Continued from page 37)

the best candidates for UV systems that rely upon penetrating the dissolved solids inherent in such ballast. A technical paper available on the U.S. EPA's website reports, "The transmissivity of the water being treated is another critical variable affecting the effectiveness of UV systems. Without accessory filtration, or other separation of solids, UV will not likely be as effective as necessary."

Ballast Capacity

An initial problem in the BWT game was the lack of systems that could adequately move ballast fast enough to keep up with commercial considerations, charter parties and in general, operational readiness. Systems do exist today that can meet even the largest vessel's needs, and some are scalable depending on the size of the vessel itself. Some are not. And, some might increase the cubic footprint of the system significantly, when they do. Is the doubling of capacity creating a system that is twice as big?

A Complicated Equation

The process of assessing the considerable list of BWT alternatives is no simple task. Based largely on regulatory and third party reporting, we've listed 14 metrics to consider. Chances are; you've got more. This is a good place to start. And yes, it is time to get started. More troubling than the possibility of making the wrong decision with regard to your BWT system should be the coming crush of shipowners all trying to get systems installed at the same time. Depending on who you talk to, that global manufacturing capacity may or may not be there. What then?

The Coast Guard BWT standard is here and the ratification of a similar, more mature IMO benchmark is just around the corner. It's finally time to go shopping. When you do, make sure you've done your homework. There may be no "Silver Bullet" but amongst the pack of 63+ (and counting) technologies on the market, there is a certain solution for you and your fleet. Finding it is another thing altogether.

Size DOES matter:

Rated at 6,800 m3/hr. Installed Venturi Injectors (VI's) from N.E.I. Treatment Systems create a mixture of oxygen stripping inert gas and water, upon ballast water intake. The VI does not negatively impact the vessels' ballasting rates, making this an attractive option for those vessels requiring higher rates and capacities.

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C2	Bayonne Dry Dock & Repair Corp.	www.bayonnedrydock.com	(201) 823-9296
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Maritime Professional

2013 Editorial Calendar

Q1 Maritime Risk

Publish: **March 2013**

Ad Closing: Feb 15th

Risk is everywhere on the waterfront. Define, control and mitigate your maritime risk, with guidance taken directly from the pages of this edition

- Finance, Insurance, P&I Cover
- Security, Safety & Operations
- Prevention and Response & Loss Control
- Maritime Salvage & Response

ASNE Day (Feb 21-22 Jacksonville, FL)
Seatrade Cruise Shipping (Mar 11-14 Miami Beach, FL)
CMA Shipping 2013 (Mar 18-20 Stamford, CT)
AWO Spring (Apr 16-19 Washington, DC)
Workboats Exchange (April 1-4)
OTC 2013 (May 6-9 Houston, TX)
Marine Money (May 8 Houston, TX)

Q2 Energy - Offshore Exploration & Transportation

Publish: **May 2013**

Ad Closing: May 1st

The oil and gas sector gets the MarPro treatment, with in-depth reports on the sector.

- Classification & Ship Registries: The CommonThread to Quality
- LNG: Upstream, Downstream & Your Bottom Line
- Navigating the New Normal: Regulatory, Safety & Profit Centers
- Offshore Support Evolves: For Operators, Designers & Shipyards

NorShipping 2013 (Jun 4-7 Oslo, NO)
Marine Money Week (June TBA New York, NY)

Q3 Training & Security

Publish: **Sept 2013**

Ad Closing: Sept 1st

MarPro explores the most important aspects of ocean shipping. As safety and regulatory compliance parameters rapidly evolve, so too will training and education requirements and shipbuilding standards. Find out how, why and when each will impact your bottom line.

- Finance, Insurance, P&I Cover
- Security, Safety & Operations
- Prevention and Response & Loss Control
- Maritime Salvage & Response

Int'l Workboat Show (Oct 9-11 New Orleans, LA)
American Waterways Operators (Oct 16-19 Miami, FL)
Europort Rotterdam (Nov 5-8 Rotterdam, NL)
SNAME Annual Meeting (Nov 6-8 TBA)

Q4 Shipbuilding, Repair & Conversion

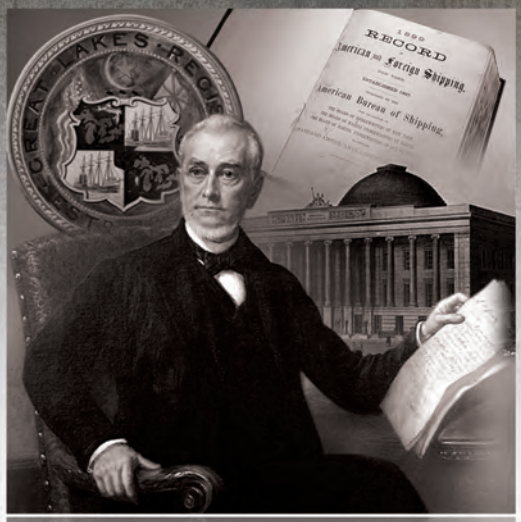
Publish: **Nov 2013**

Ad Closing: Nov 1st

Zeroing in on design standards, machinery, engines, hull forms and maintenance issues.

- Propulsion: Emissions Regulations & Engine Technology
- CAD/CAM & Naval Architecture: Two kinds of green
- Ballast Water Treatment: What best fits your fleet & business plan?
- Machinery & Hardware: At the heart of your operation

* Please note that the publisher reserves the right to alter this calendar. All features are subject to change in light of industry trends and developments.



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